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Gaudet, Jr. et al.

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(54) **VENTILATION SYSTEM FOR STORAGE COVERS AND METHOD OF USE**

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(65) **Prior Publication Data**

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Related U.S. Application Data

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(51) **Int. Cl.**

F24F 13/08	(2006.01)
F24F 13/10	(2006.01)
F24F 13/14	(2006.01)

(52) **U.S. Cl.**

CPC ***F24F 13/084*** (2013.01); ***F24F 13/10*** (2013.01); *F24F 13/14* (2013.01)

(58) **Field of Classification Search**

CPC F26B 13/00; F26B 13/084; F26B 19/00; F26B 23/00; F26B 25/00; A01F 25/22; A01F 25/14; A01F 25/13; B65D 88/745; B65D 88/747

USPC 34/201, 210, 218, 233

See application file for complete search history.

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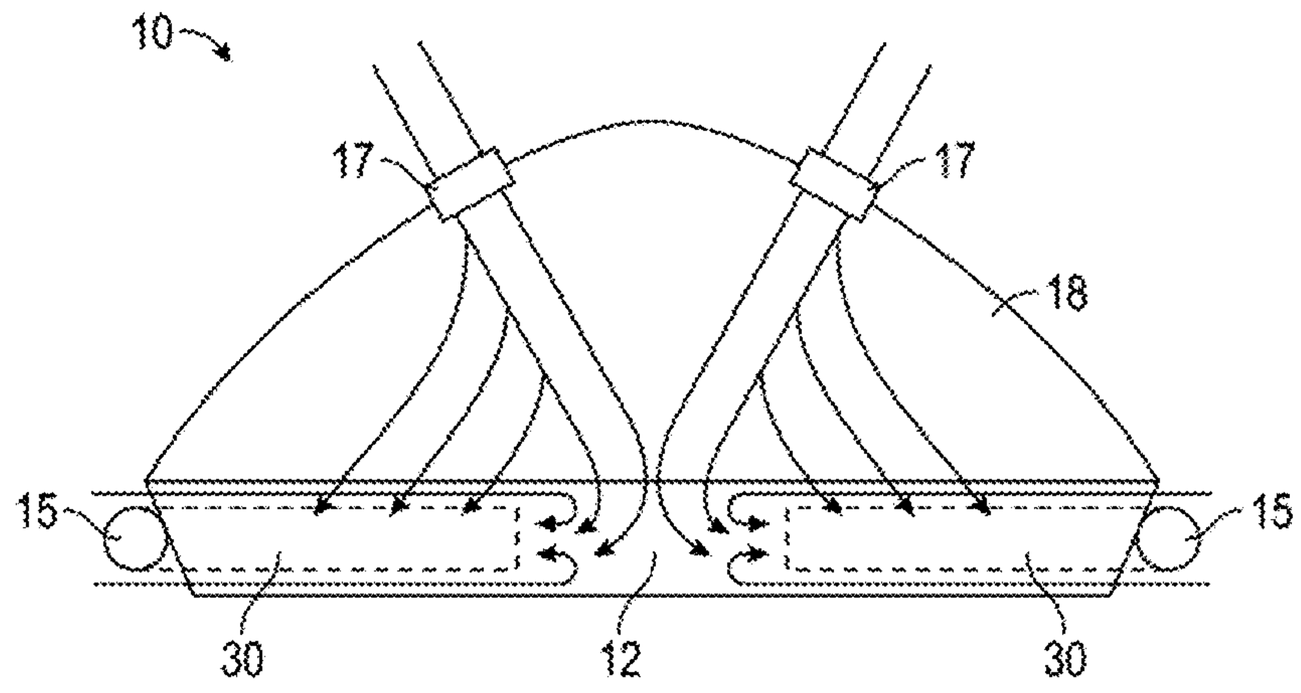
(57) **ABSTRACT**

The present invention relates to a reliable, efficient, and low cost ventilation system for storage covers that improves the distribution of air flow and improves aeration of the particulate material and the method of installing the same.

5 Claims, 22 Drawing Sheets



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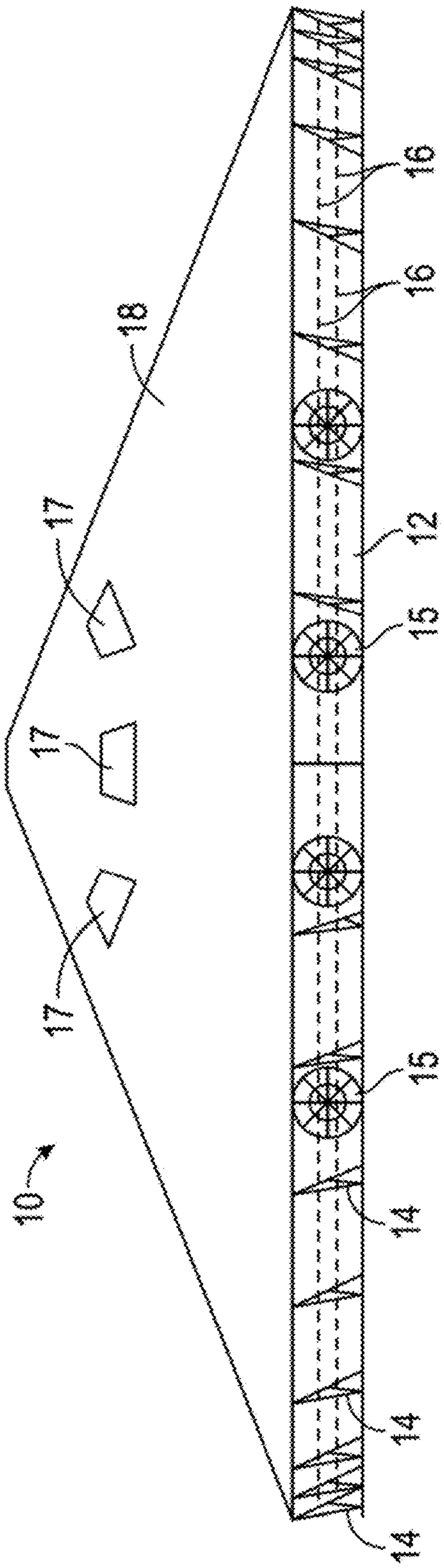

FIG. 1

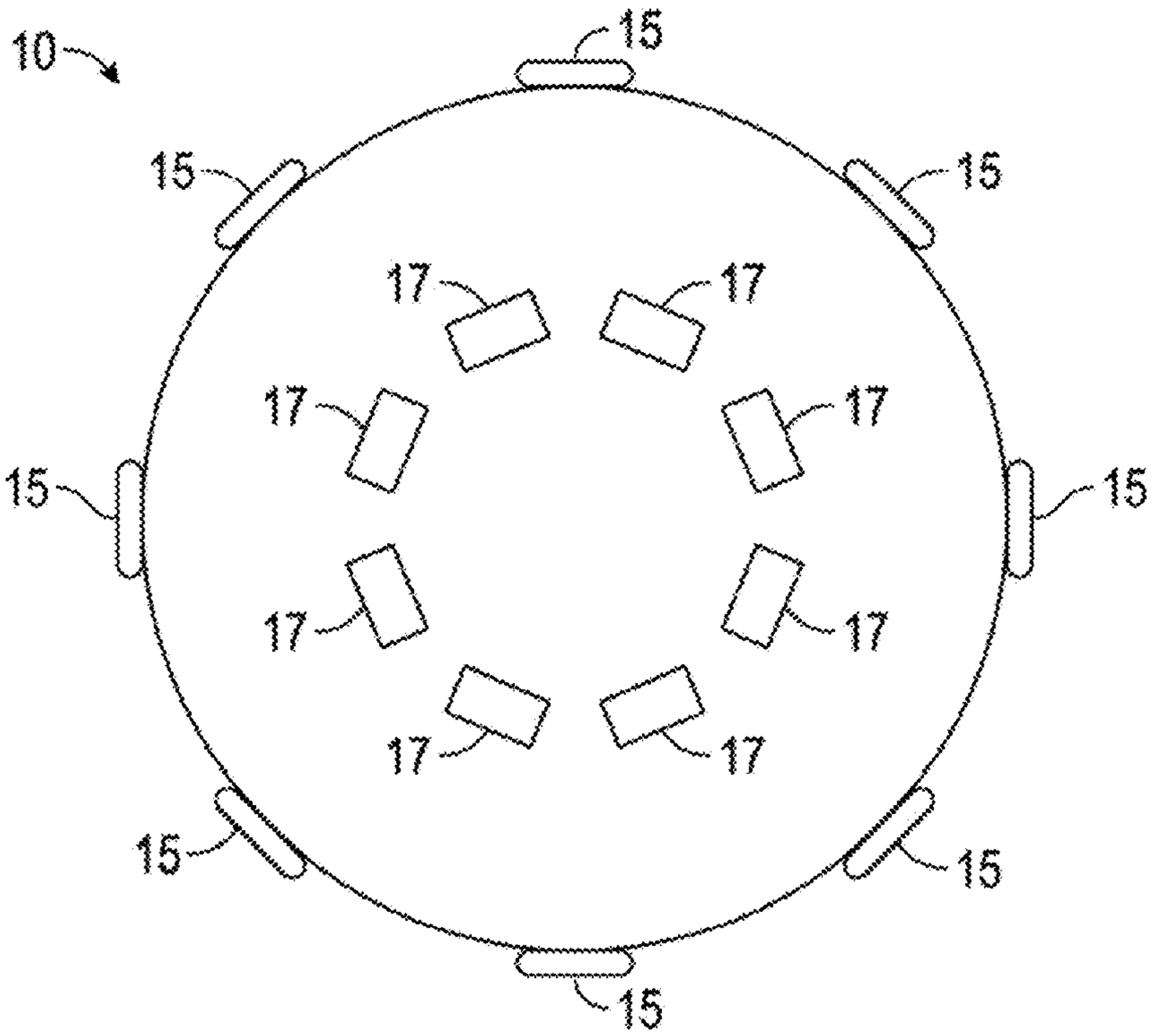
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FIG. 2

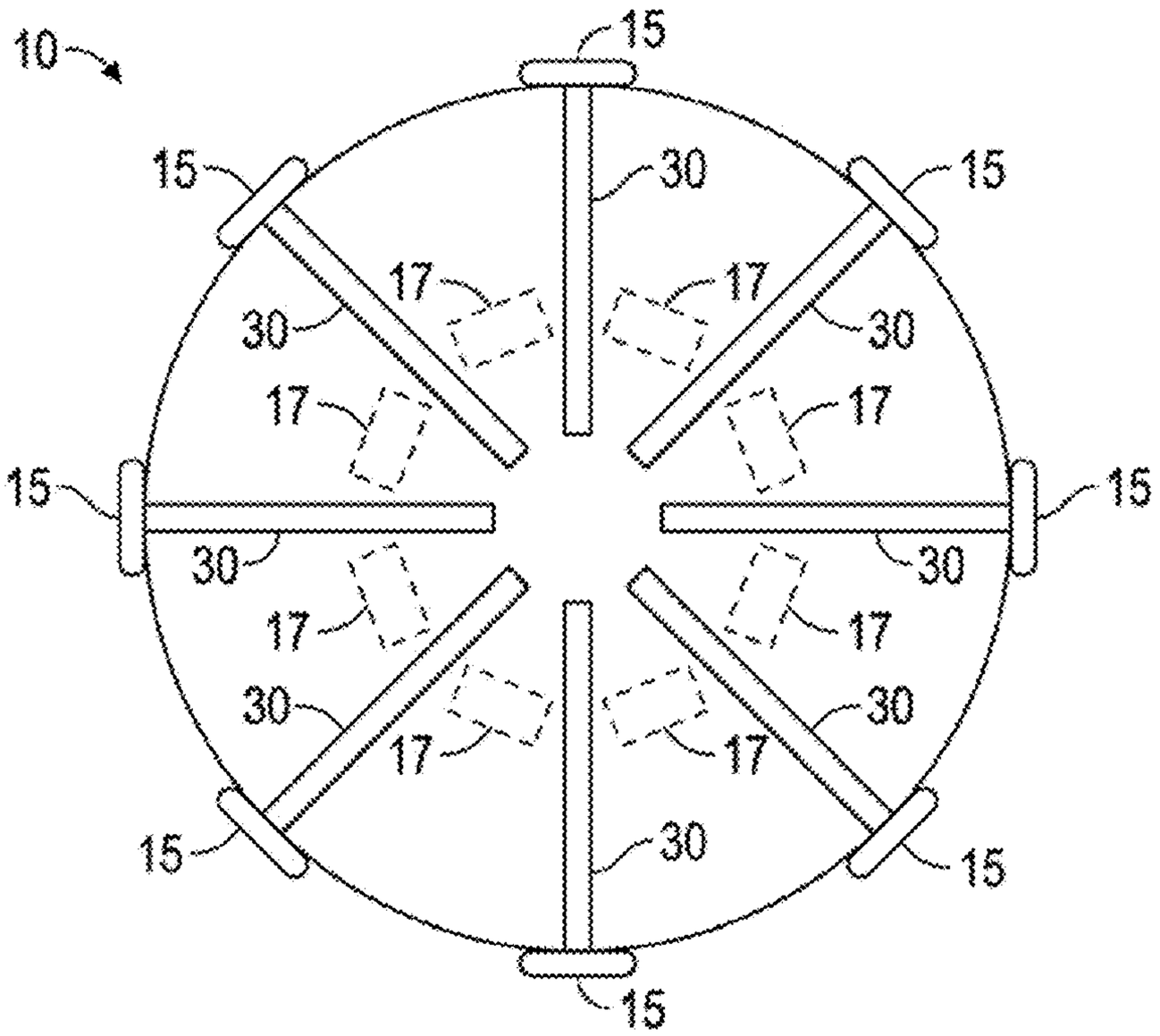
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FIG. 3

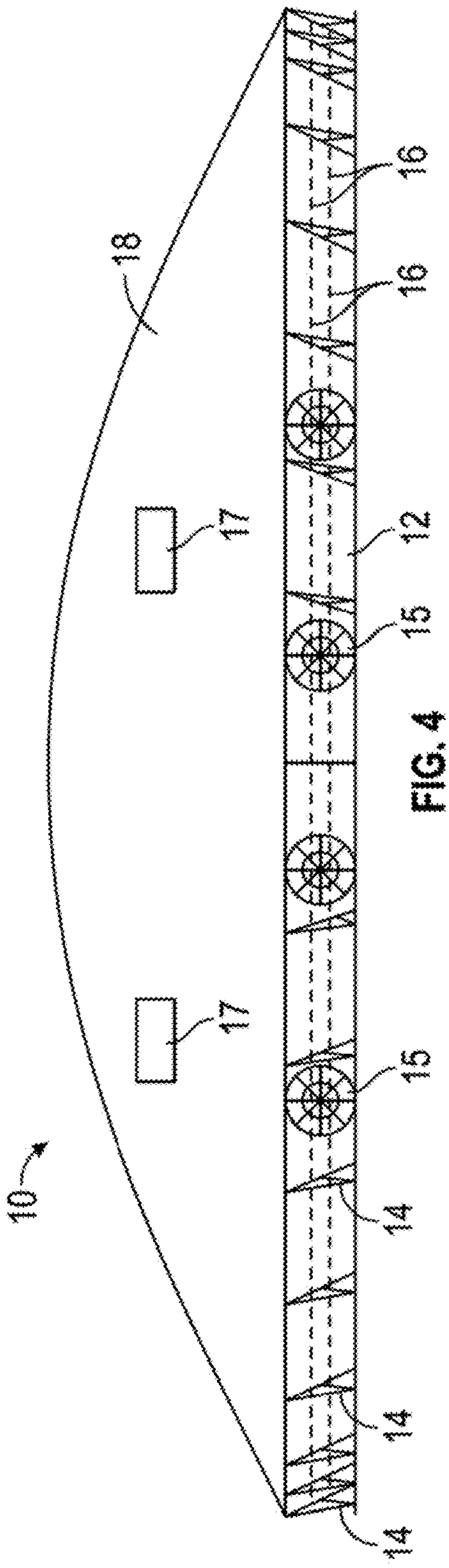

FIG. 4

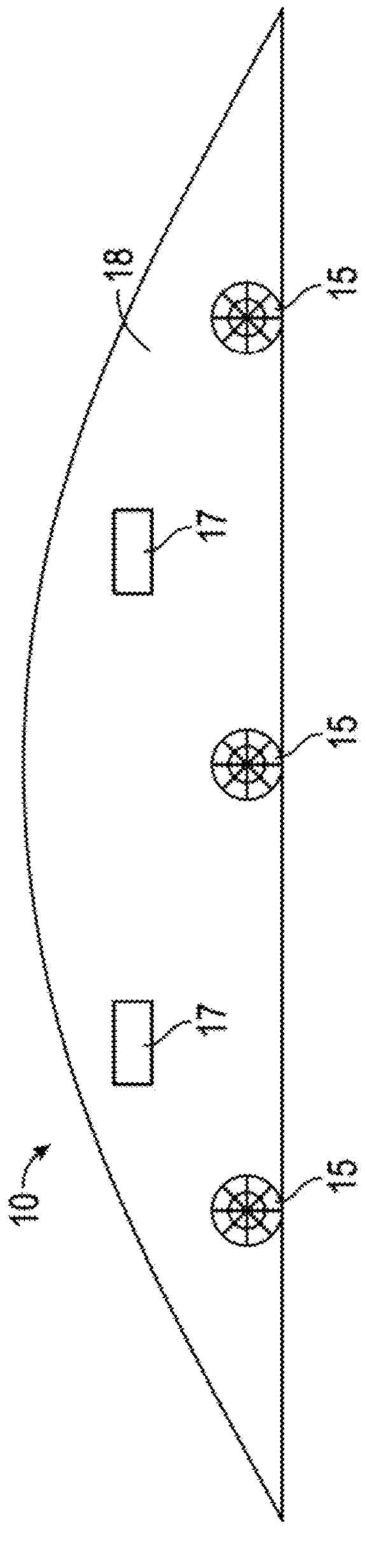

FIG. 5

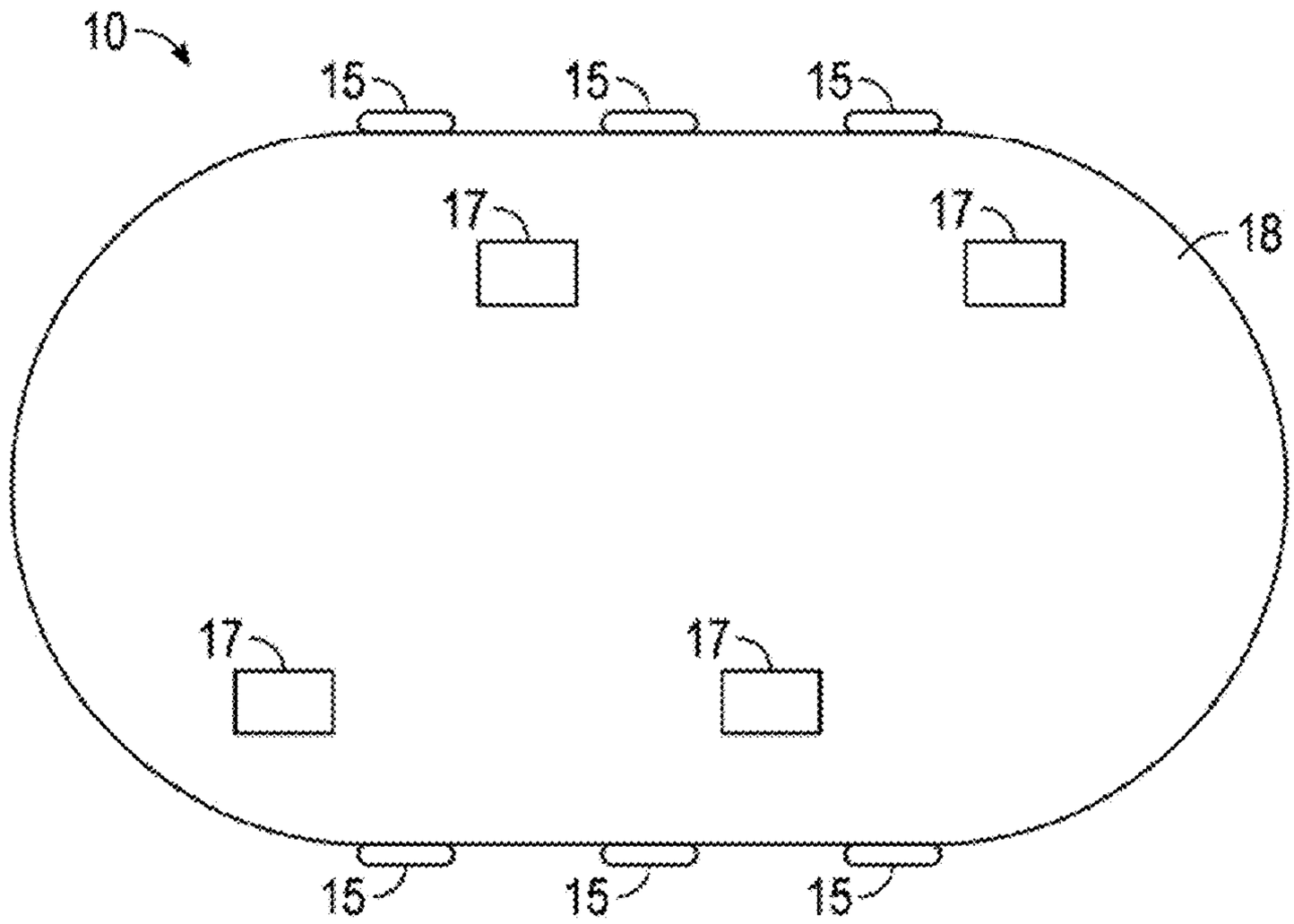
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FIG. 6

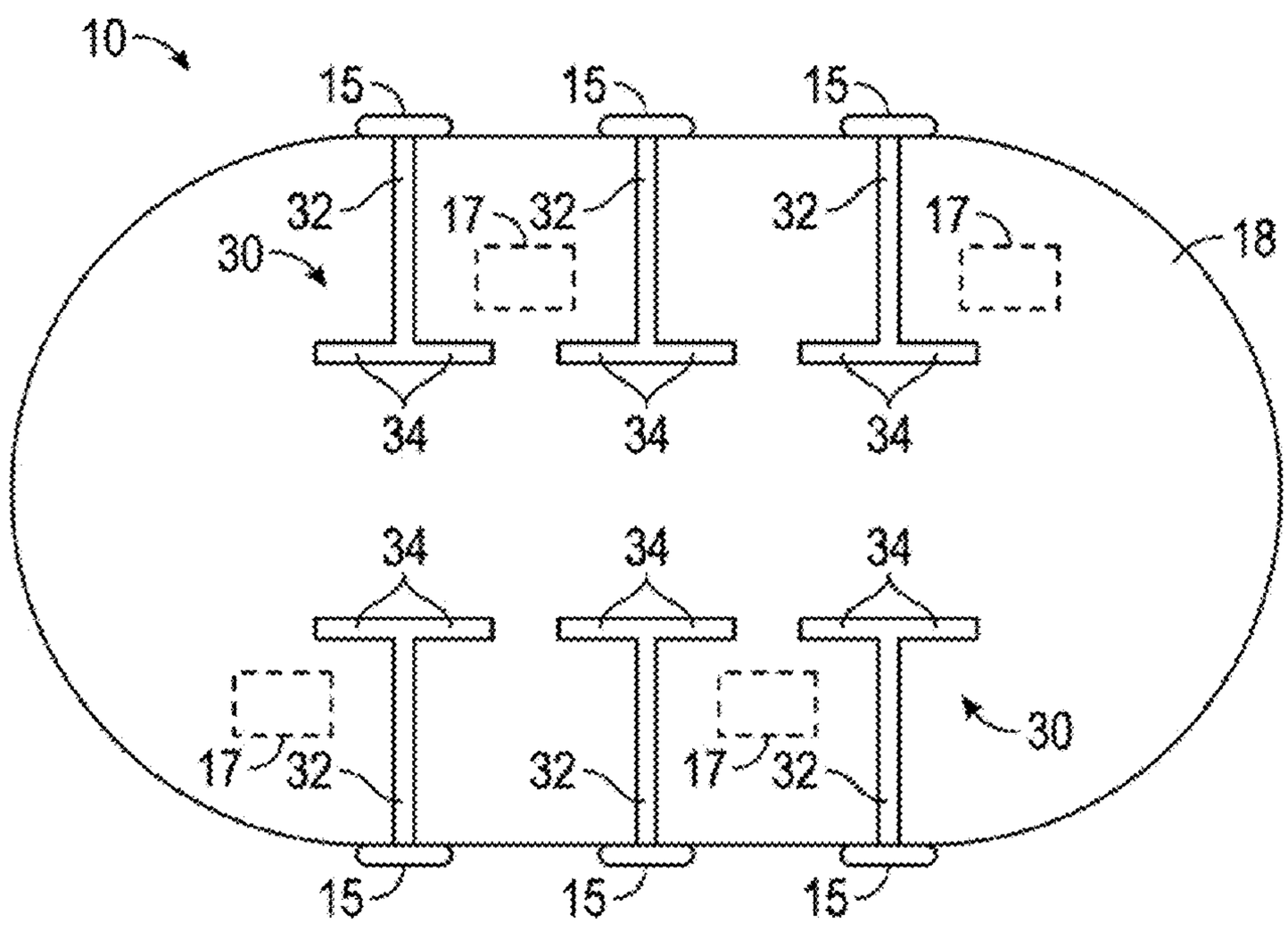
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FIG. 7

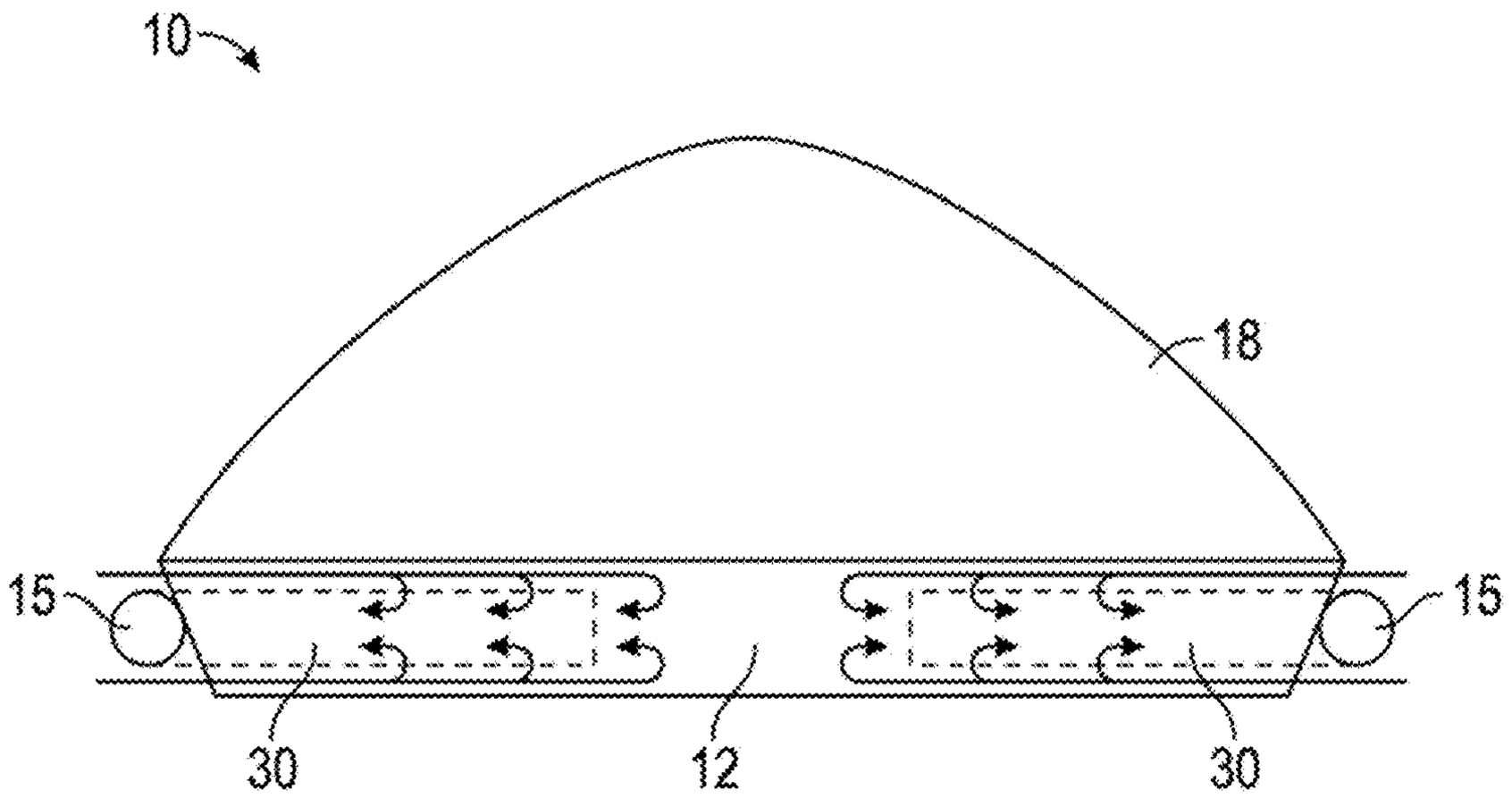

FIG. 8A

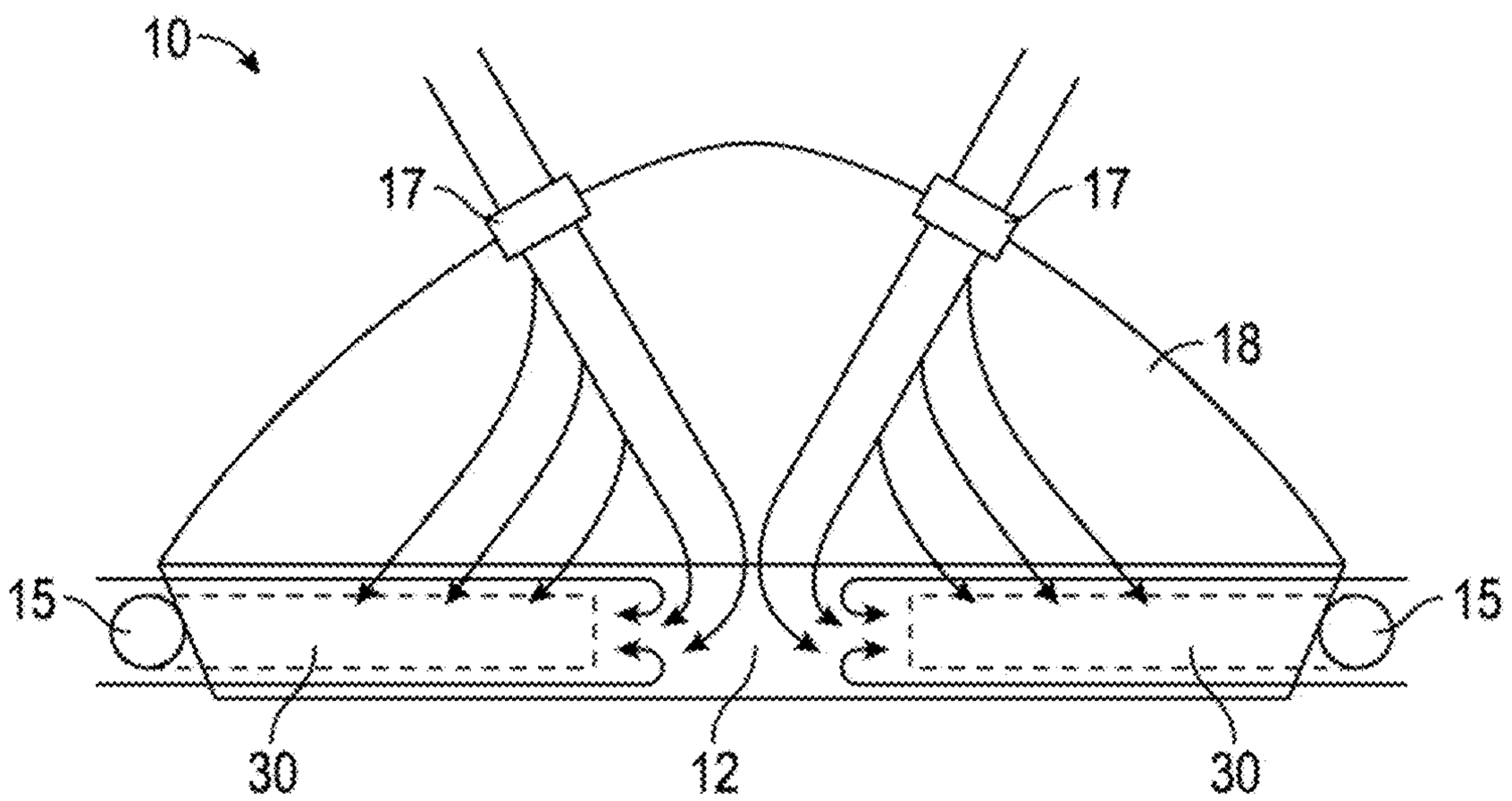

FIG. 8B

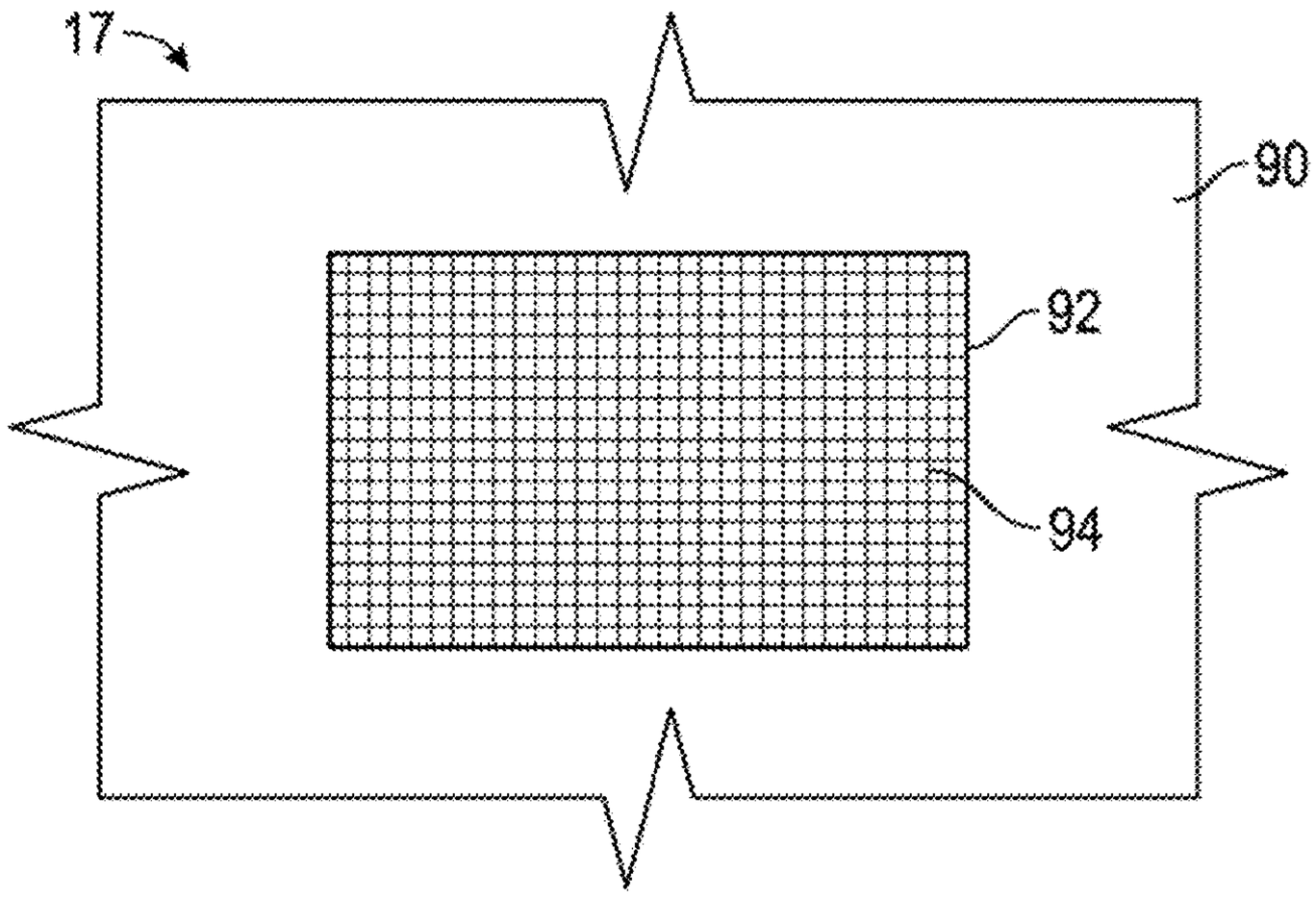

FIG. 9A

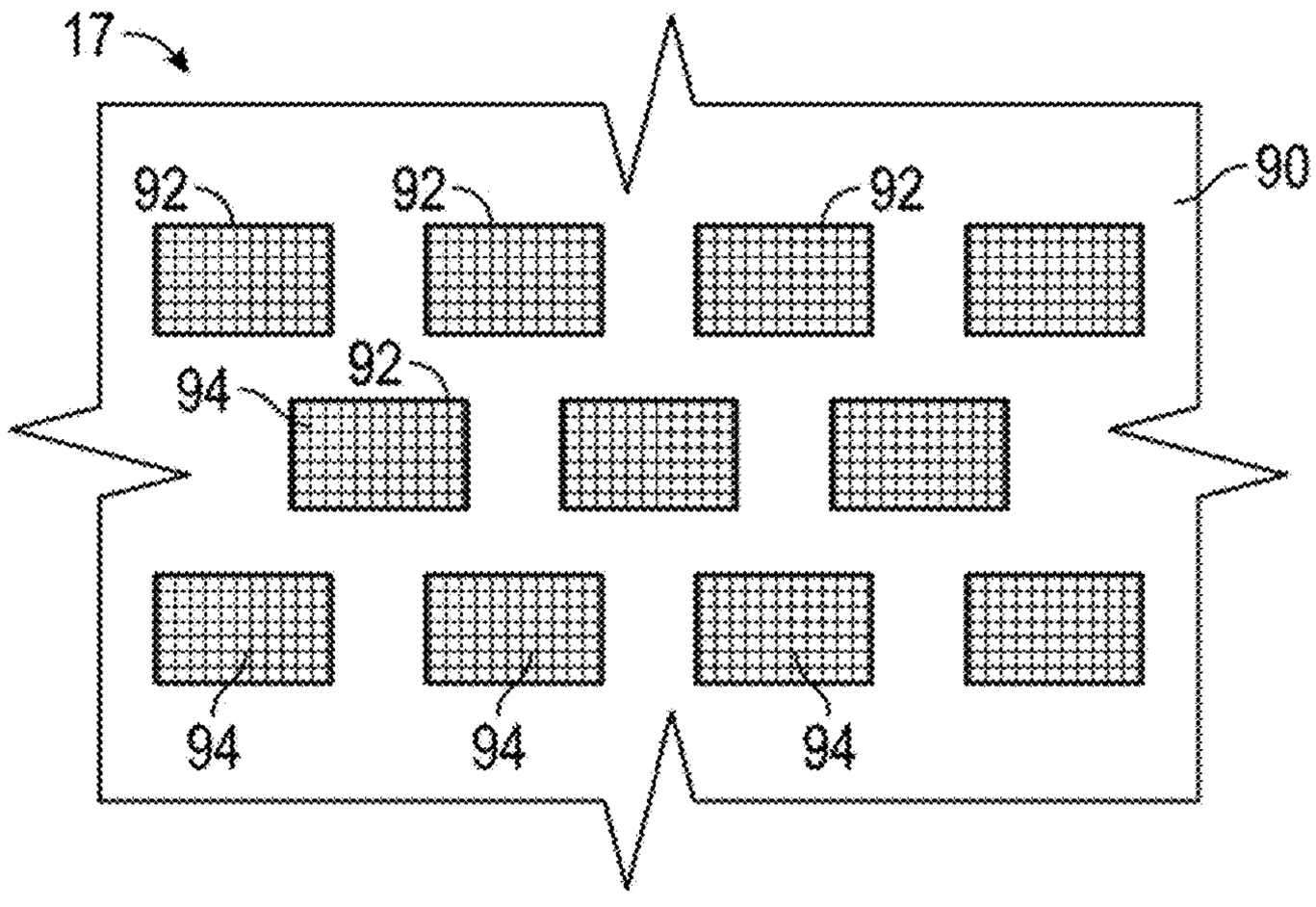

FIG. 9B

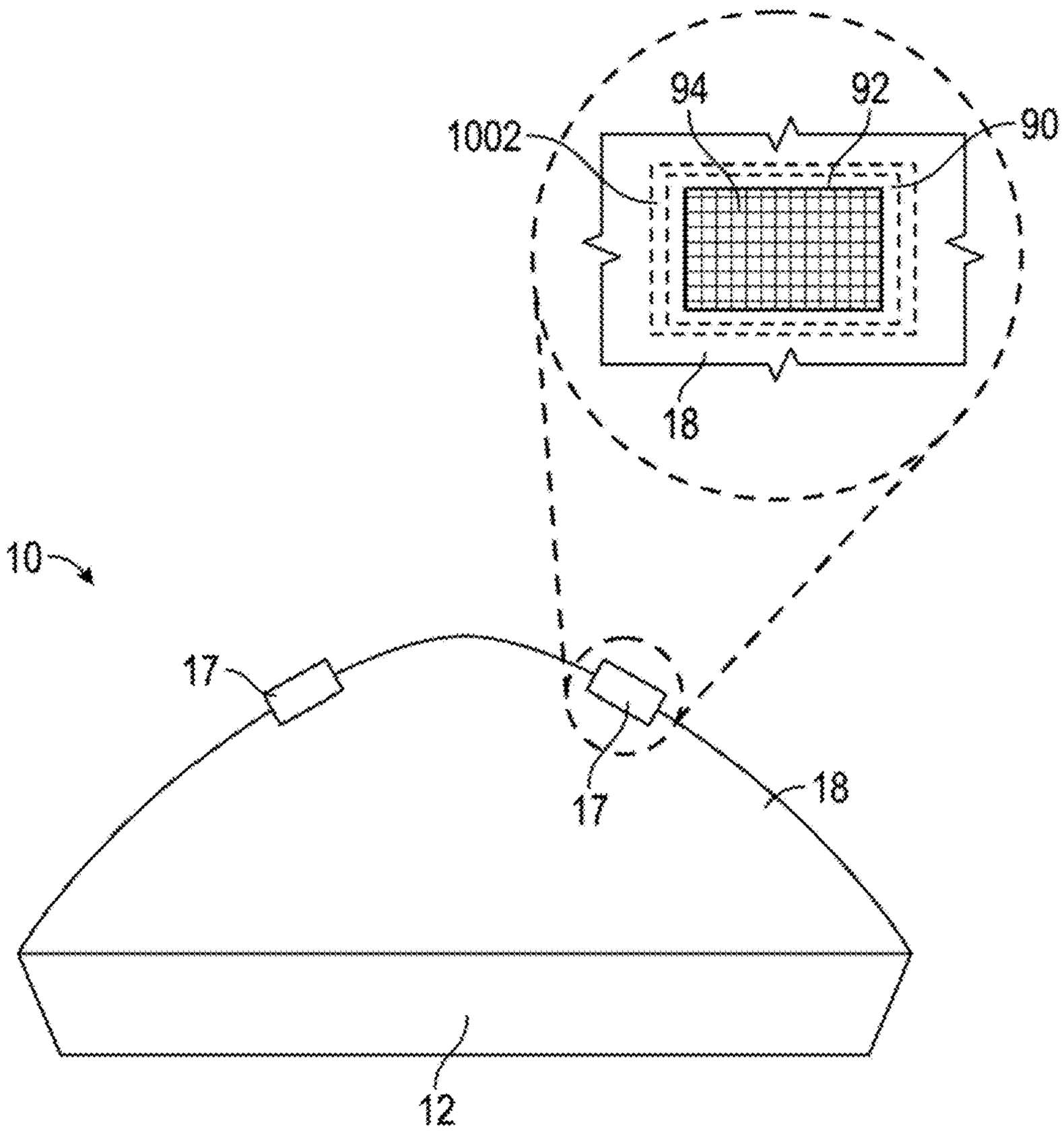

FIG. 10

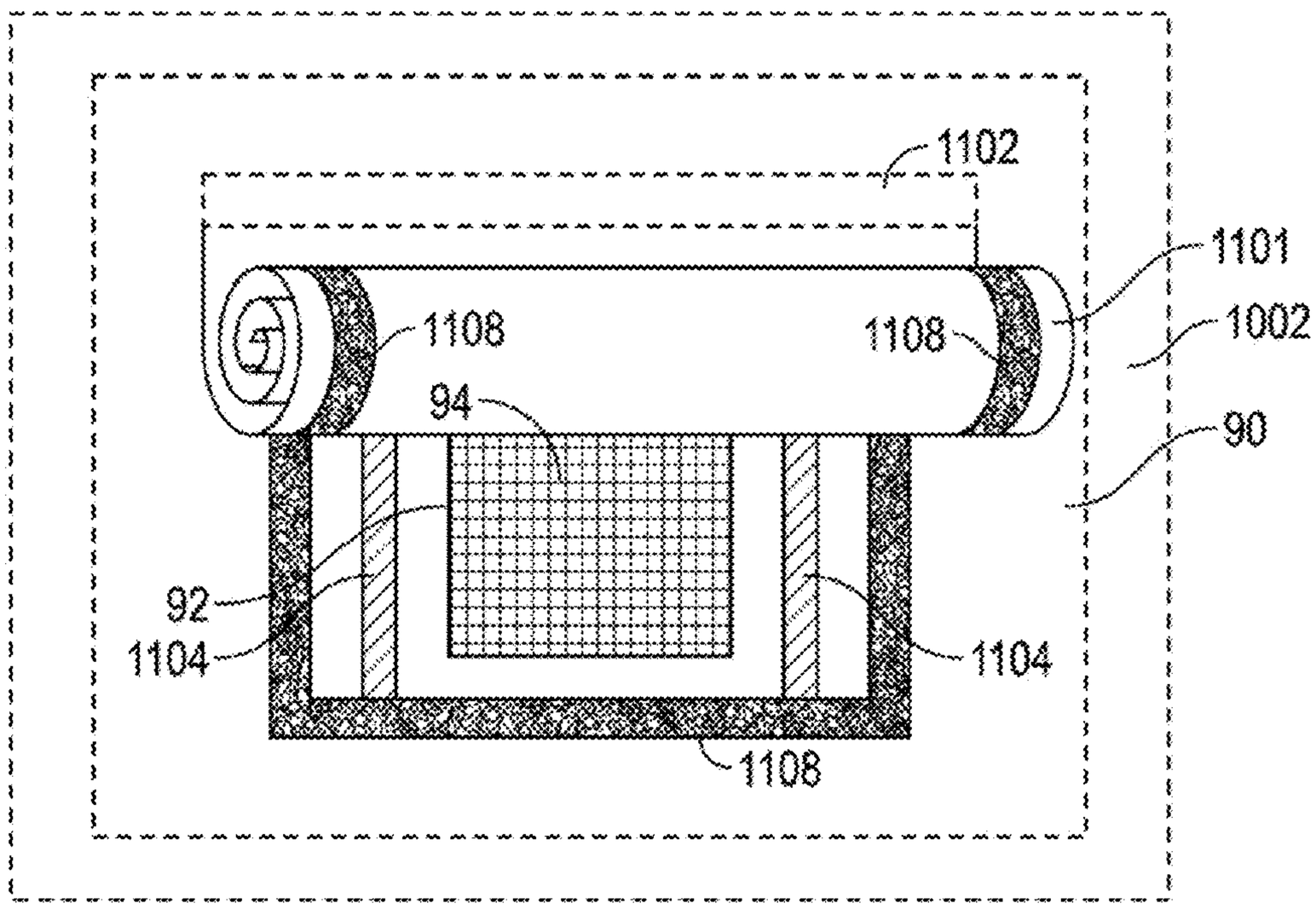

FIG. 11A

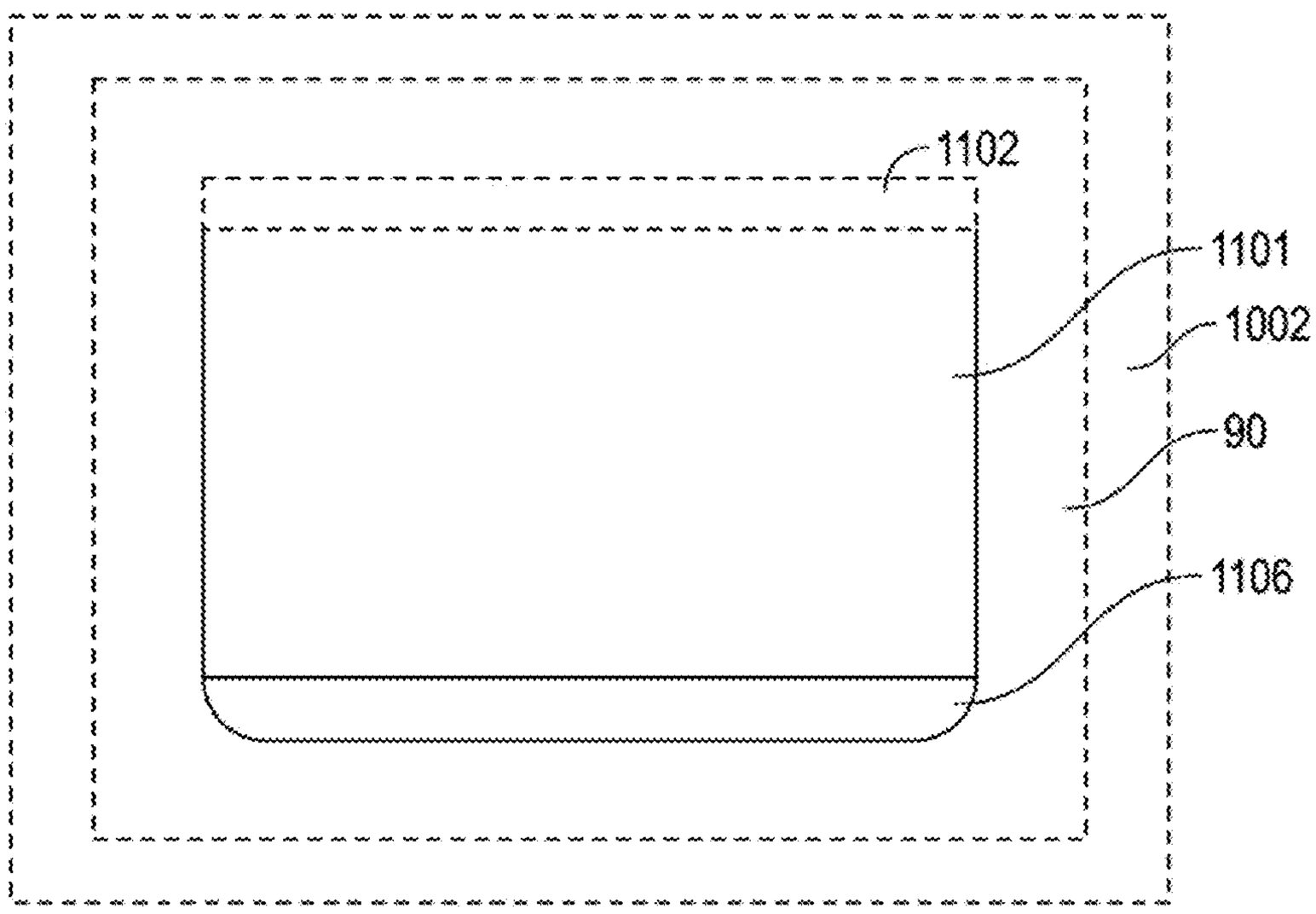

FIG. 11B

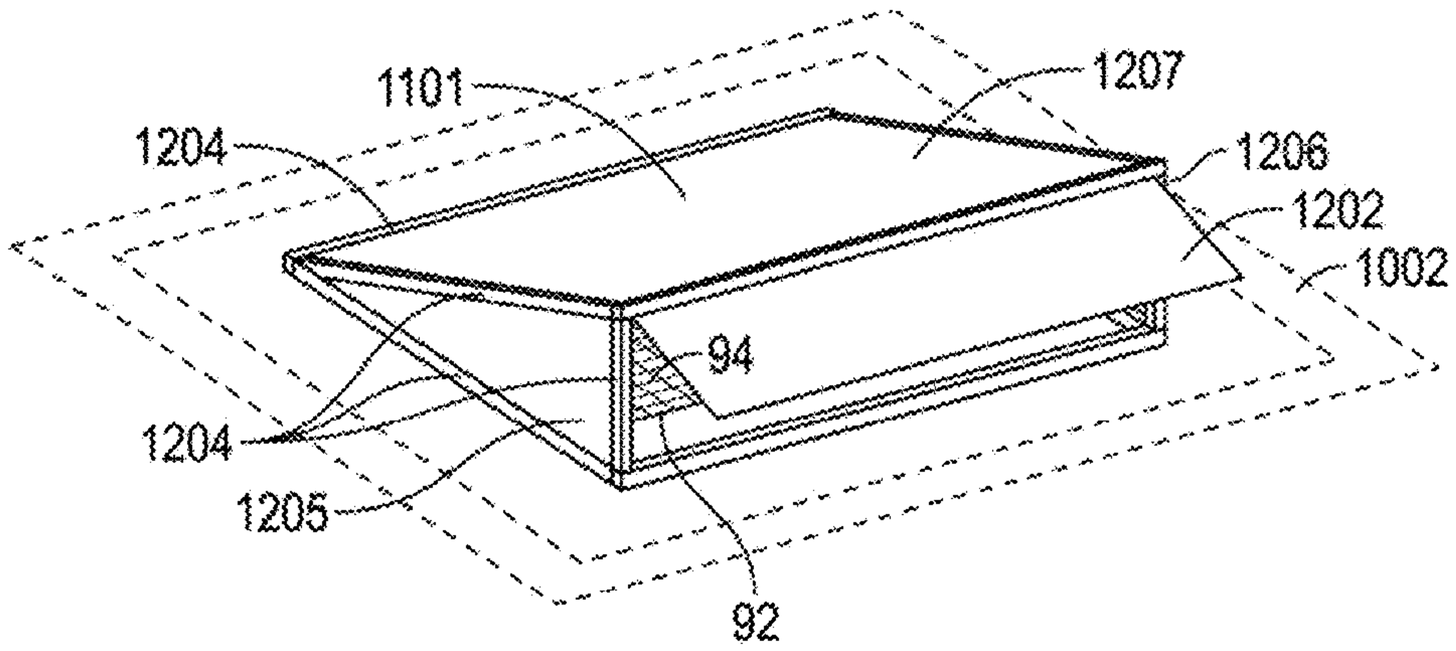
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FIG. 12

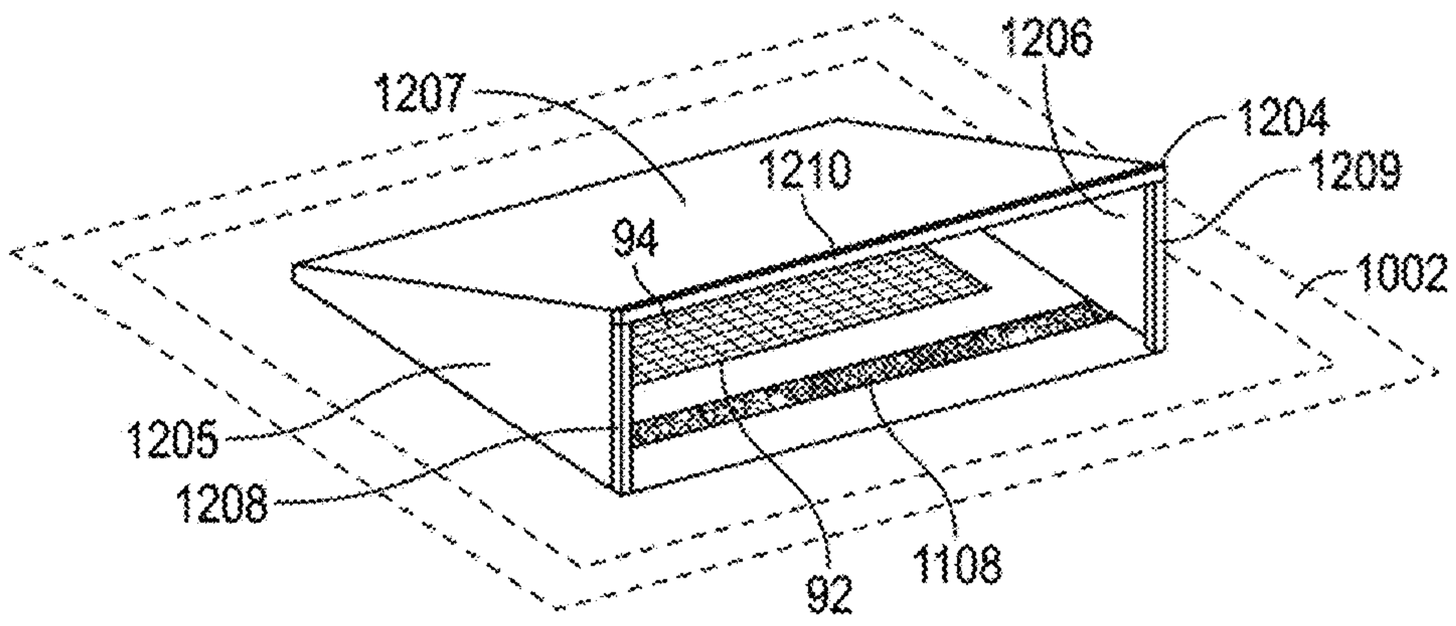
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FIG. 13

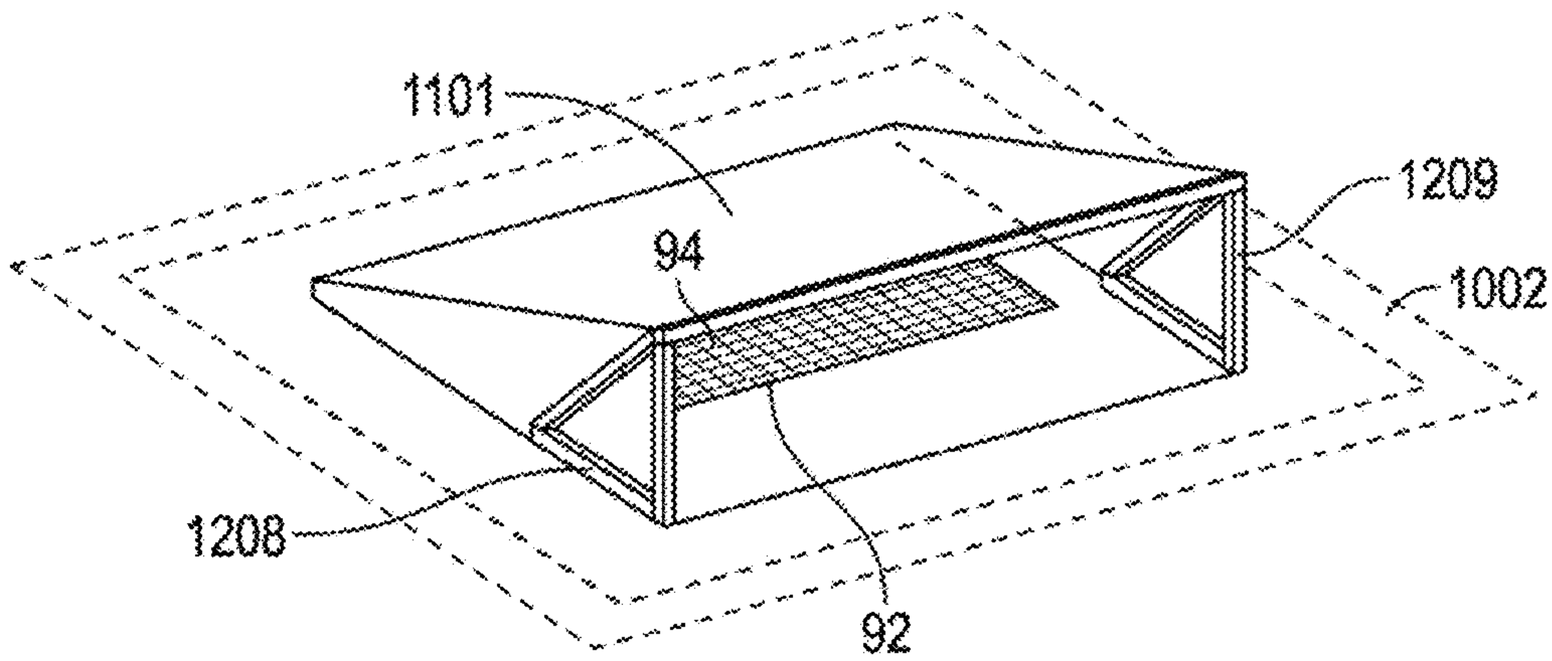


FIG. 14

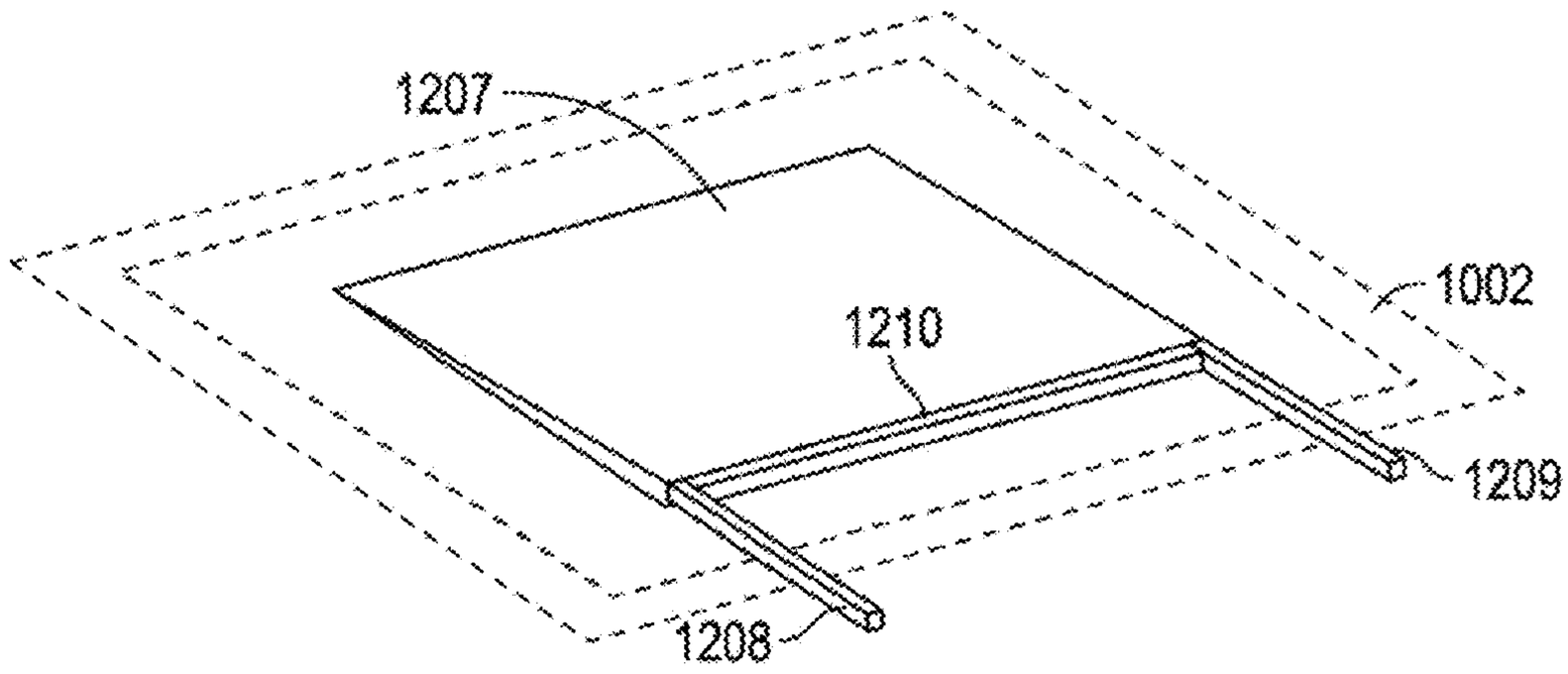


FIG. 15

FIG. 16

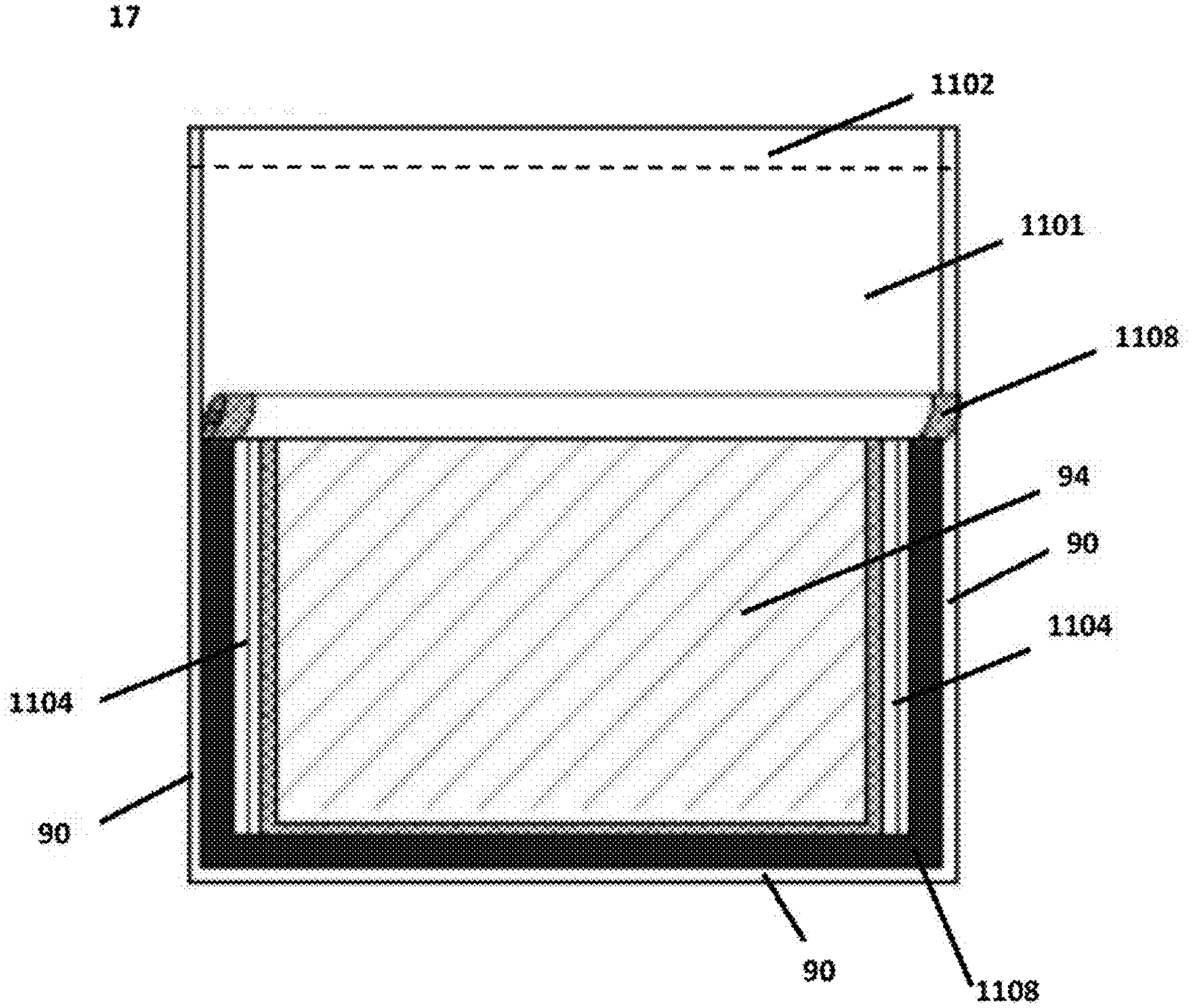


FIG. 17

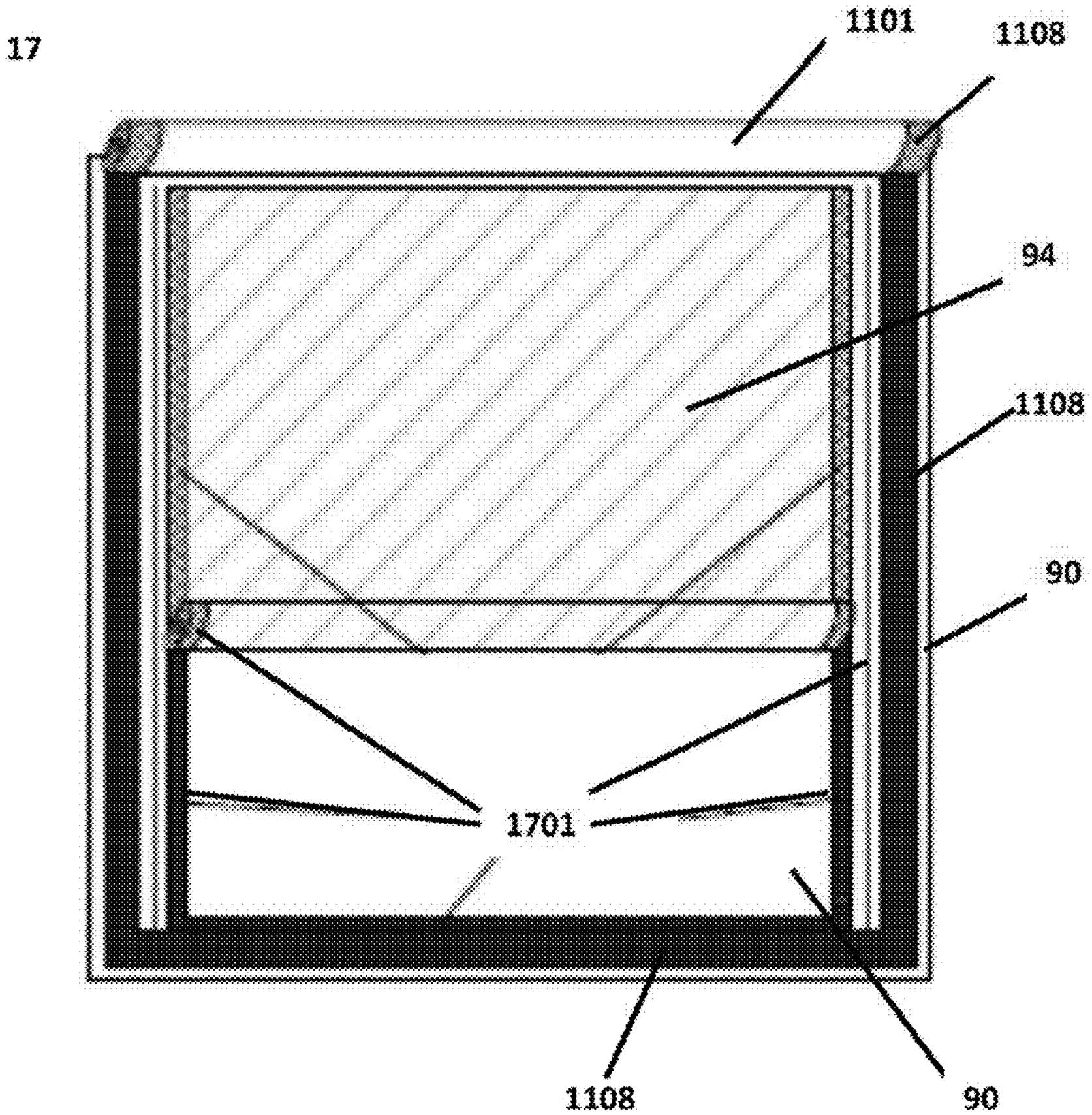


FIG. 18

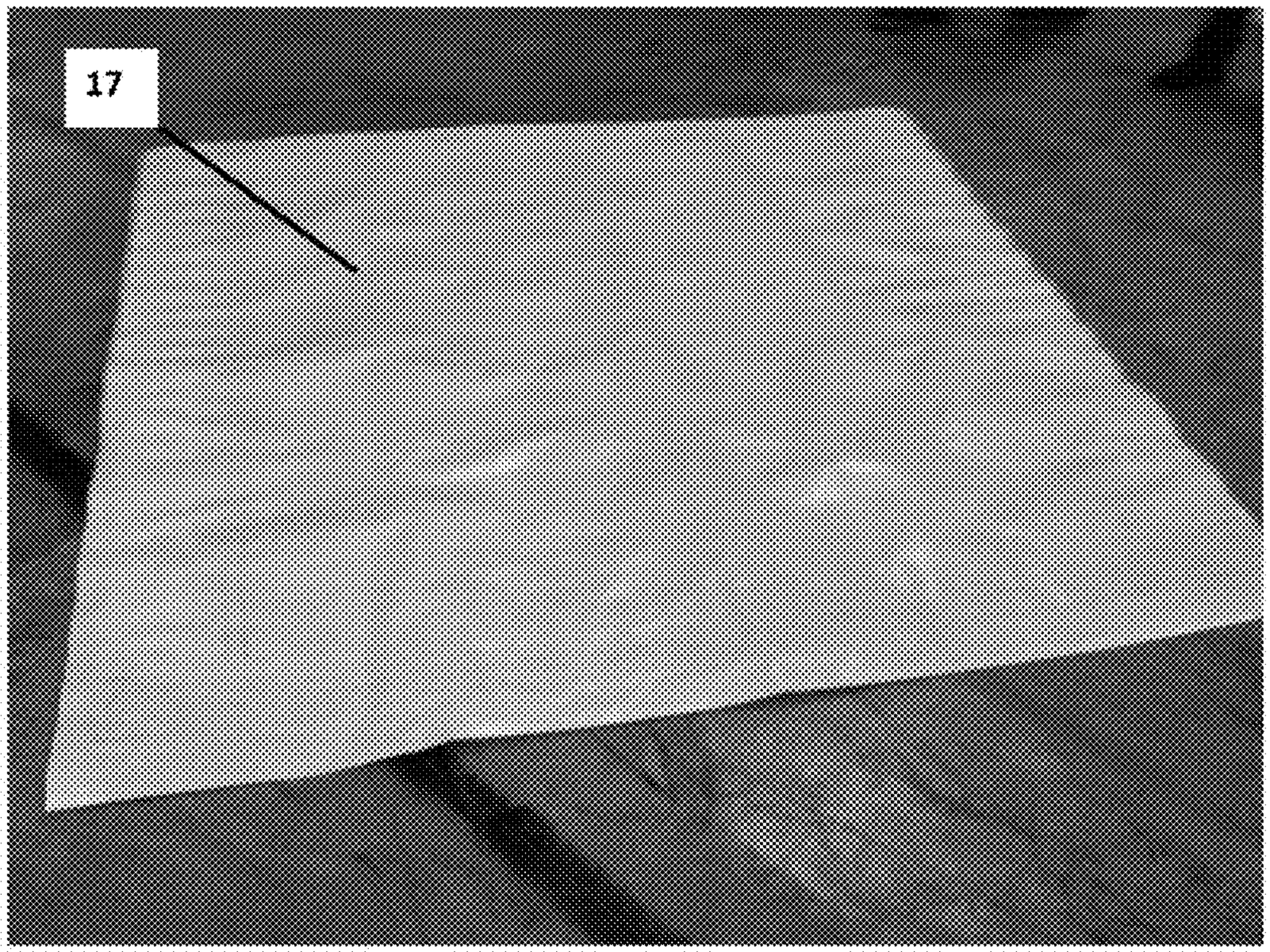


FIG. 19

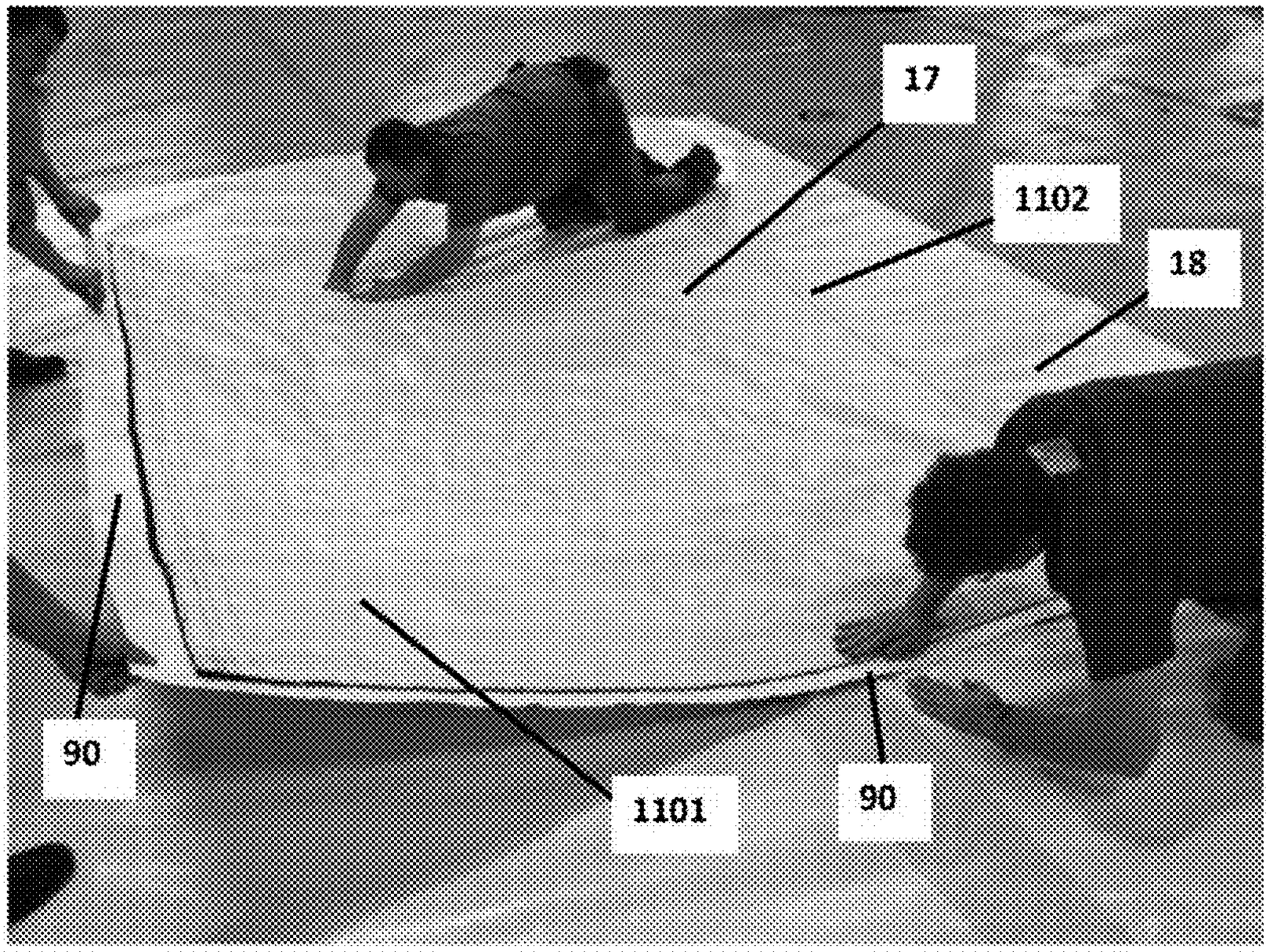


FIG. 20

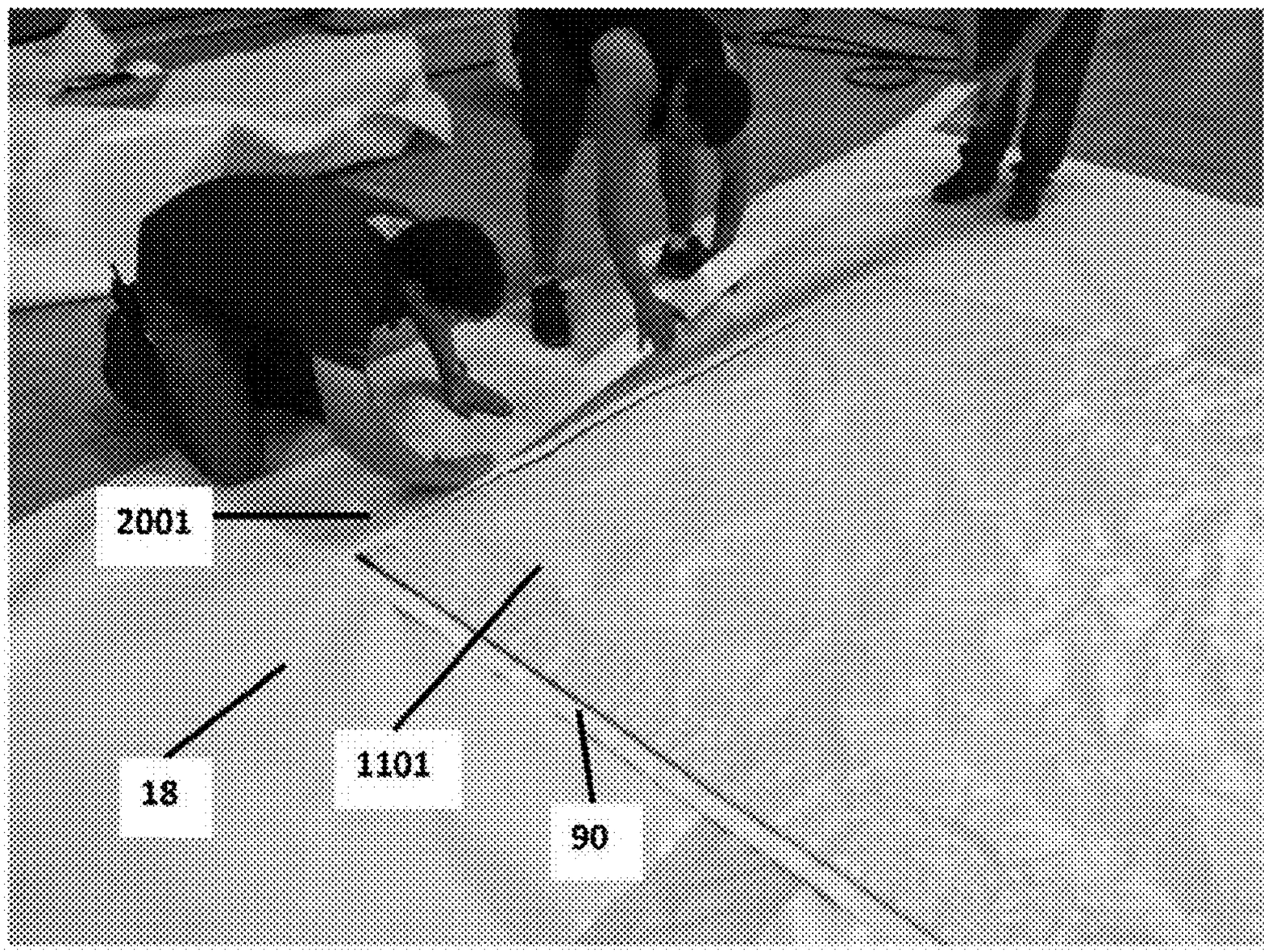


FIG. 21

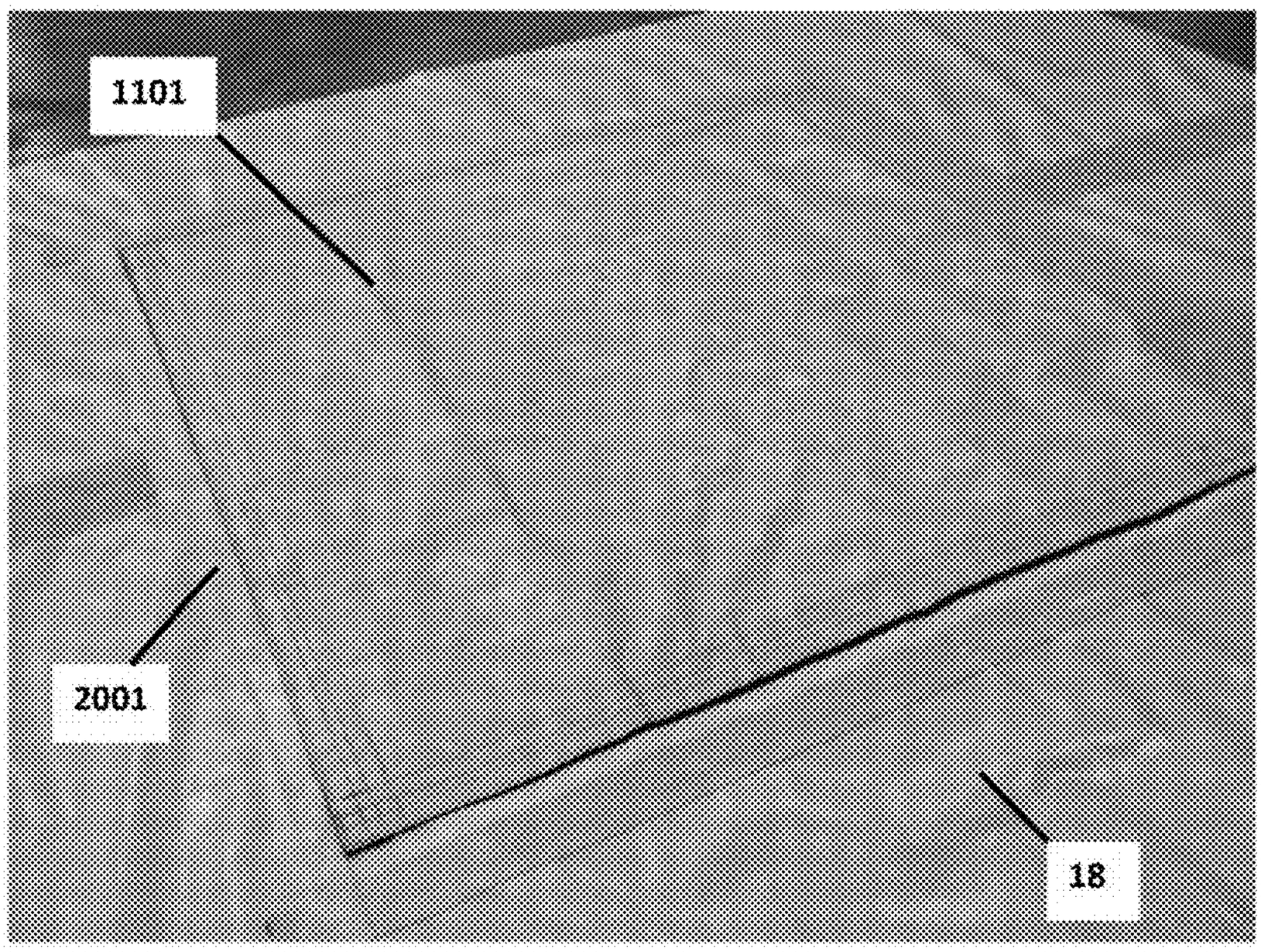


FIG. 22

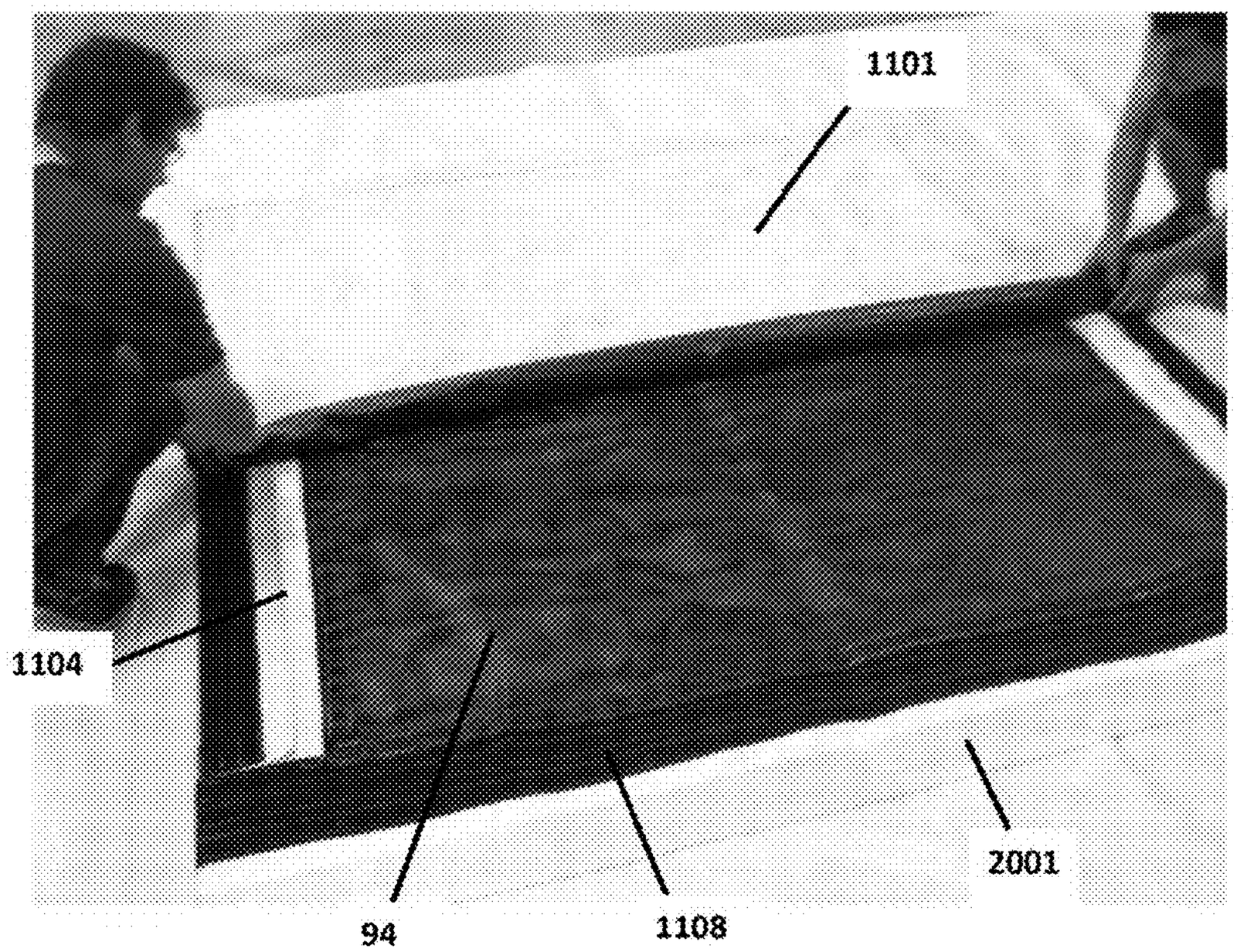


FIG. 23

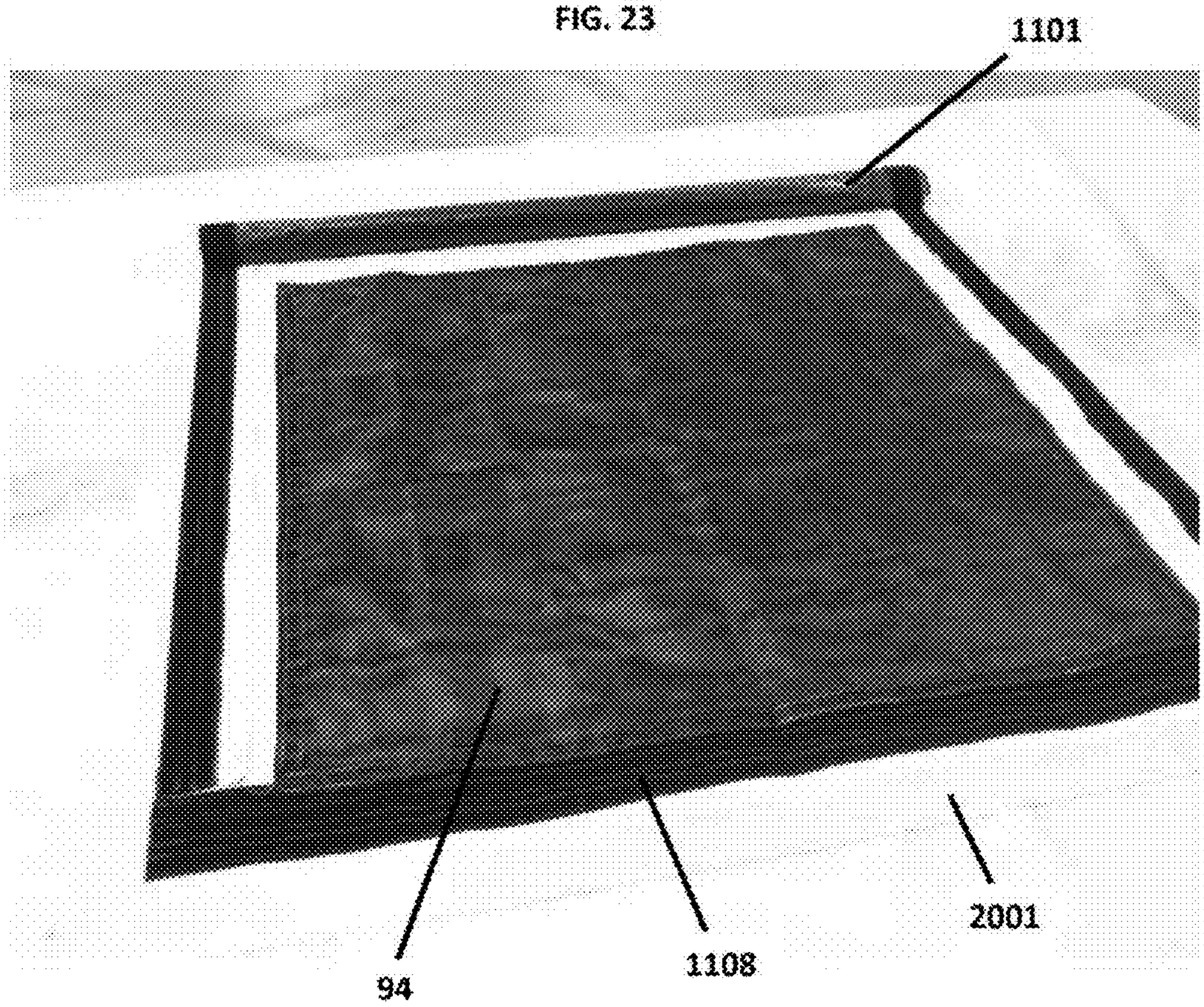


FIG. 24

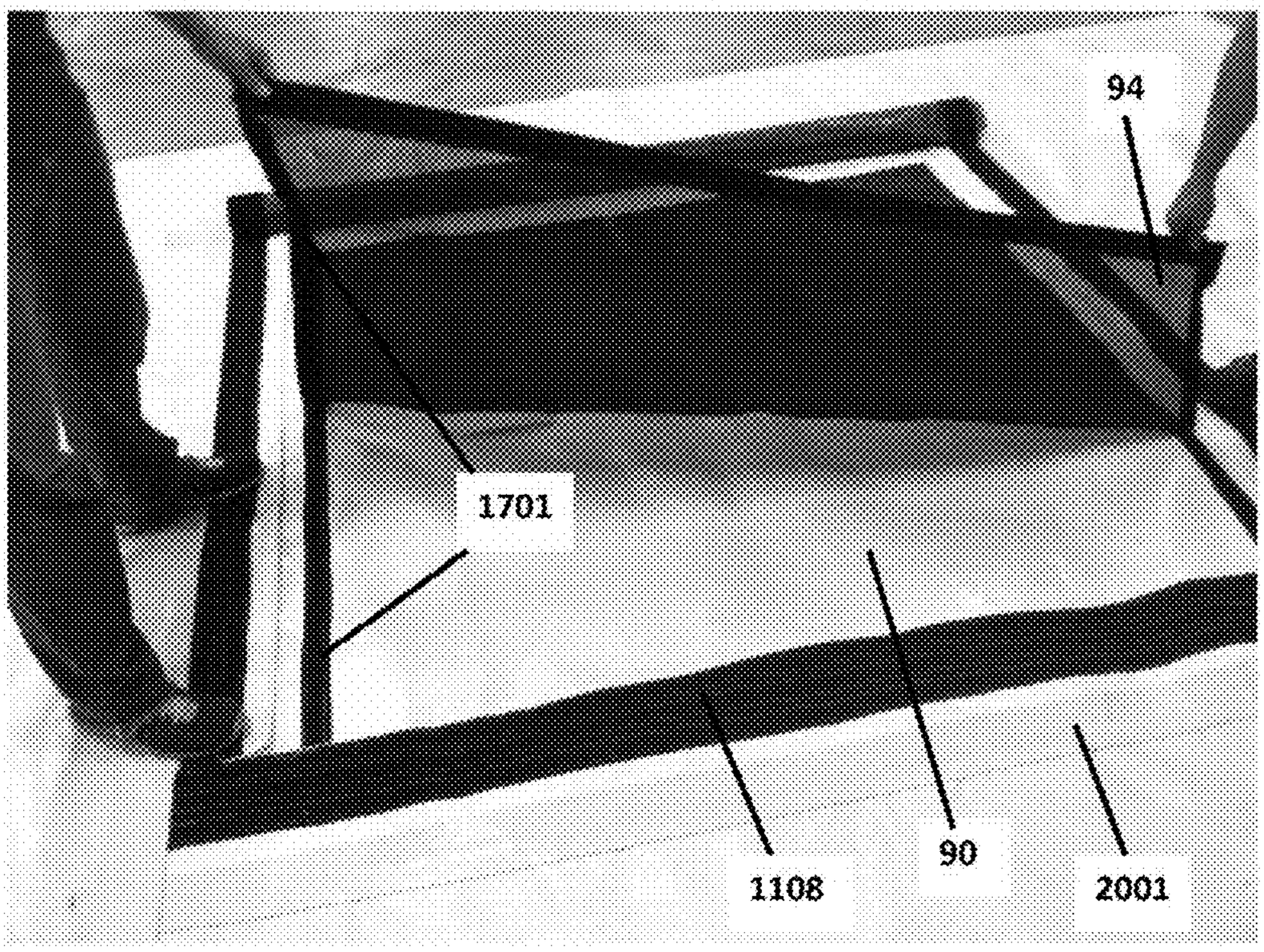


FIG. 25

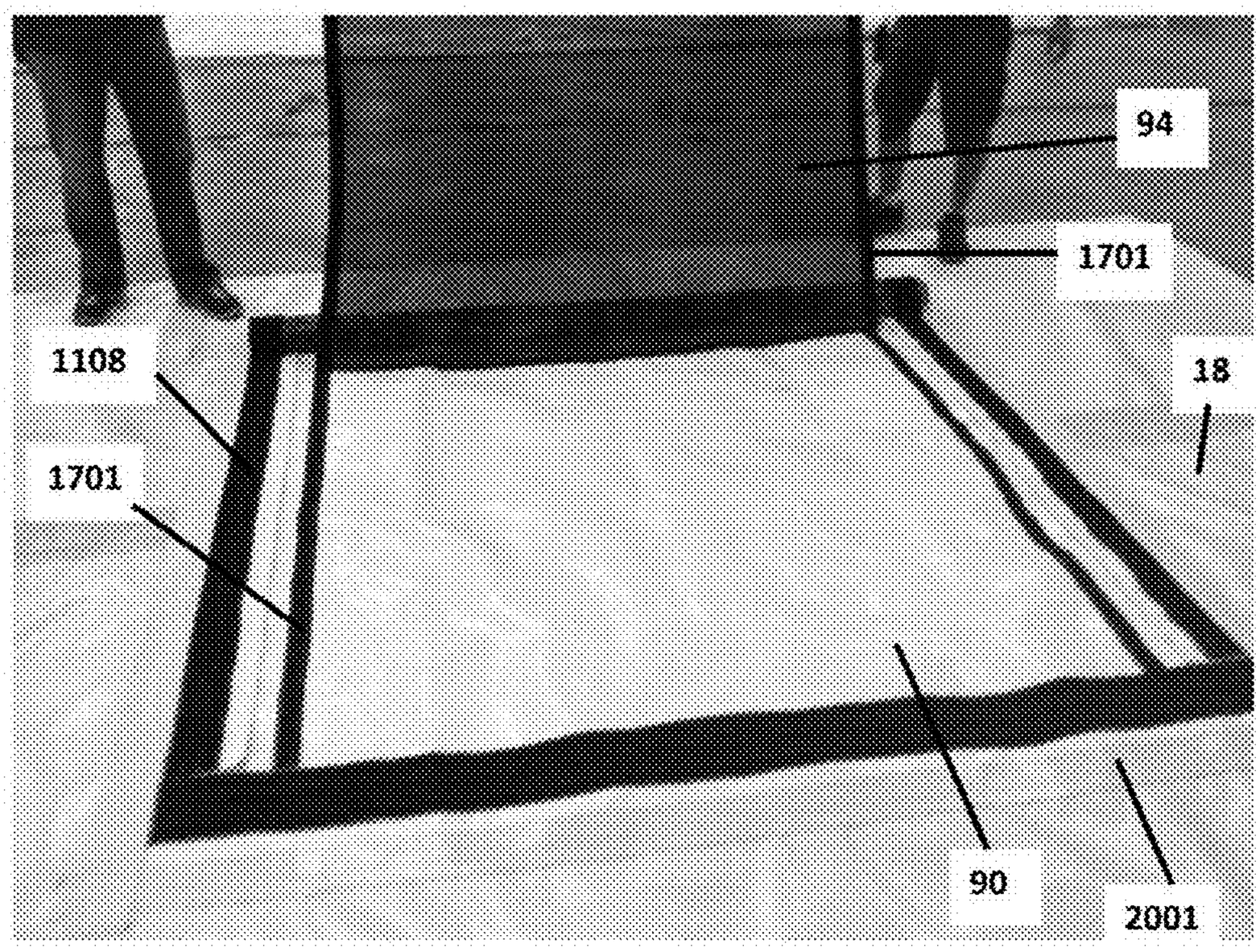


FIG. 26

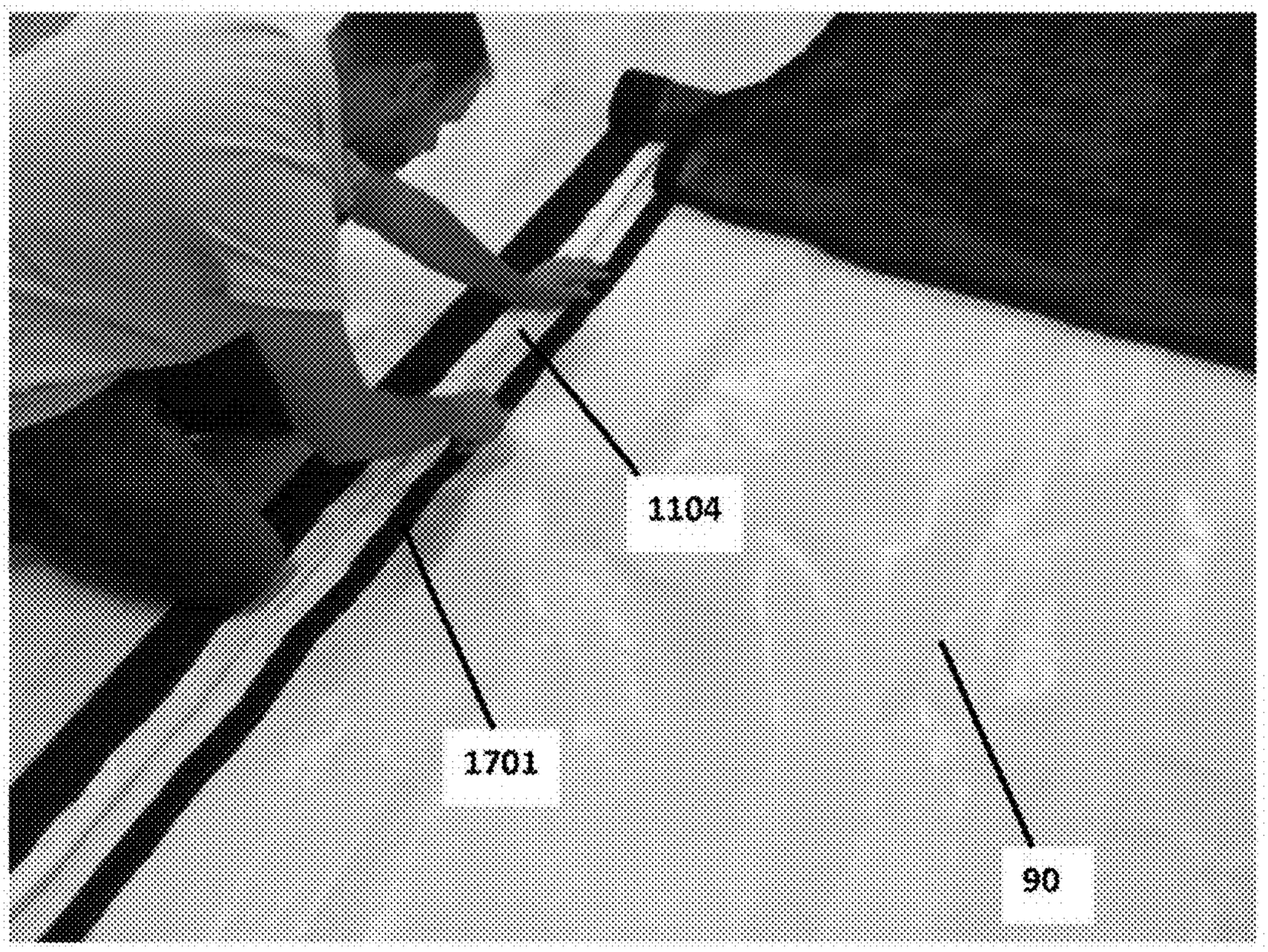
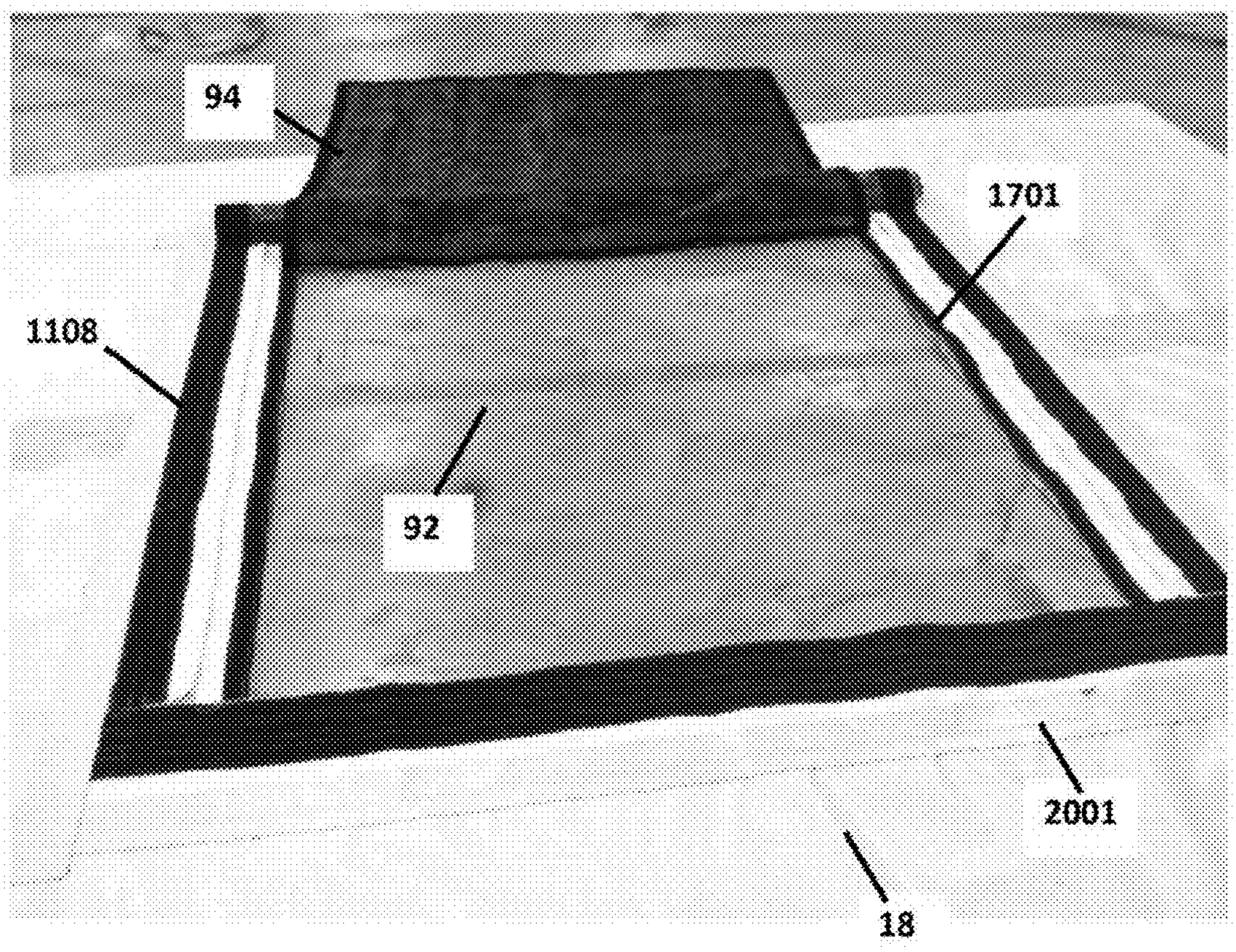


FIG. 27



VENTILATION SYSTEM FOR STORAGE COVERS AND METHOD OF USE

CONTINUATION IN PART

This application is a continuation-in-part from U.S. Non-Provisional patent application Ser. No. 14/449,765 to Donald Gaudet, Jr. and Aaron Gummer filed on Aug. 1, 2014.

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention relates to a novel system for ventilating particulate piles covered by storage covers.

II. General Background

Various types of storage covers, configured in various arrangements, have been developed for covering piles or mounds of material, such as silage (animal feed), salt, sand, calcium carbonate, grain, and the like from the effects of weather, sun, water intrusion and/or insect or rodent infestations while said material is in outside storage.

Storage covers exist in various shapes, sizes and configurations. In a first arrangement of storage covers, these storage covers consist of a fabric tarp wherein the perimeter of the fabric tarp is secured to a retaining wall extending around the perimeter of the fabric tarp. The retaining wall is often made of a perforated metal that allows air flow between the outside environment and the covered pile. At the center of the fabric tarp, and connected to the fabric tarp, exists a lifting ring. After the storage cover is deployed and attached to the lifting ring, the lifting ring is raised and the particulate material is deposited through the lifting ring and under the storage cover.

In an alternative arrangement, particulate material is first deposited within the retaining wall. After the particulate material is deposited, the fabric tarp is then deployed over the particulate material, and the perimeter of the fabric tarp is secured to the retaining wall. In contrast to the above described arrangement, the fabric tarp is deployed over the particulate material after the particulate material is piled, and thus does not utilize a lifting ring to deposit particulate material beneath the storage cover.

In yet another type of arrangement of storage covers, the storage covers consist of a fabric tarp covering a pile of particulate material wherein the perimeter of the fabric tarp lays approximately parallel to the ground, and does not utilize a retaining wall. In this arrangement, the fabric tarp is deployed over the particulate material after the particulate material is piled, and also does not utilize a lifting ring to deposit particulate material beneath the storage cover.

Particulate material covered by storage covers often suffer from the problems of mold growth, moisture migration, and insect or rodent infestation. Aeration of the particulate pile is a method of preventing and/or remedying these problems. Aeration requires a mechanical system that moves air through the particulate pile. A common aeration method in particulate piles covered by a storage cover is to use fans installed at the base of the particulate pile to create suction airflow underneath the storage cover. However, this method does not result in creation of air flow through the height of the pile and instead concentrates the air flow at the base of the pile.

In some aeration methods, aeration pipes are attached to aeration fans wherein the aeration pipes are placed at the base of the particulate pile and extend towards the center of the particulate pile. In some instances additional aeration pipes are also placed on top of the particulate material (and underneath the storage cover). However, even the use of these additional aeration pipes does not result in an adequate air flow throughout the height of the particulate pile. Thus, the problem of providing adequate distribution of aeration air to the particulate material of a pile continues to exist. The present invention provides a reliable, efficient, and low cost ventilation system for storage covers that improves the distribution of air flow and improves aeration of the particulate material.

SUMMARY OF THE PRESENT INVENTION

The present invention contemplates a vent comprising a vent body; a mesh layer removably attached to said vent body wherein said mesh layer is movable from an attached to a detached position and wherein when said mesh layer is in said attached position, said mesh layer at least partially covers said vent body; and a flap attached to said vent body wherein said flap is movable from an opened position to a closed position and wherein when said flap is in said closed position, said flap covers said mesh layer.

The present invention further contemplates a method for installing comprising the steps of providing a vent wherein said vent comprises: (i) a vent body wherein said vent body comprises a perimeter; (ii) a mesh layer removably attached to said vent body wherein said mesh layer is movable from an attached to a detached position and wherein when said mesh layer is in said attached position, said mesh layer at least partially covers said vent body; and (iii) a flap attached to said vent body wherein said flap is movable from an opened position to a closed position and wherein when said flap is in said closed position, said flap covers said mesh layer; providing a tarp body; placing said vent on top of said tarp body; attaching said perimeter of said vent body to said tarp body; moving said flap to at least a partially open position; moving said mesh layer to at least a partially detached position; removing a portion of said vent body to expose a portion of said tarp body; removing a portion of said exposed tarp body; and moving said mesh layer into said attached position.

The present invention further contemplates a kit for ventilating a storage cover comprising a vent wherein said vent comprises: (i) a vent body wherein said vent body comprises a perimeter, (ii) a mesh layer removably attached to said vent body wherein said mesh layer is movable from an attached to a detached position and wherein when said mesh layer is in said attached position, said mesh layer at least partially covers said vent body; and (iii) a flap attached to said vent body wherein said flap is movable from an opened position to a closed position and wherein when said flap is in said closed position, said flap covers said mesh layer, tape; and a cutting device.

BRIEF DESCRIPTION OF THE DRAWINGS

For a further understanding of the nature and objects of the present invention, reference should be had to the following descriptions taken in conjunction with the accompanying drawings in which like parts are given like reference numerals.

FIG. **1** shows a front view of a particulate pile surrounded by a retaining wall and covered by a storage cover having vents.

FIG. **2** shows a plan view of a particulate pile covered by a circular-shaped storage cover having vents.

FIG. **3** shows an interior plan view of a particulate pile, outfitted with aeration pipes and fans, covered by a circular shaped storage cover having vents.

FIG. **4** shows a front view of a particulate pile surrounded by a retaining wall and covered by an oval-shaped storage cover having vents.

FIG. **5** shows a front view of a particulate pile covered by an oval-shaped storage cover having vents wherein the perimeter of the storage cover lays on the ground.

FIG. **6** shows a plan view of a particulate pile covered by an oval-shaped storage cover having vents.

FIG. **7** shows an interior plan view of a particulate pile, outfitted with aeration pipes and fans, covered by an oval-shaped storage cover having vents.

FIG. **8**A shows the pathway of aeration air through a particulate pile covered by a storage cover without vents.

FIG. **8**B shows the pathway of aeration air through a particulate pile covered by a storage cover with vents.

FIG. **9**A shows a plan view of a vent comprised of a single opening covered by mesh.

FIG. **9**B shows a plan view of a vent comprised of multiple openings covered by mesh.

FIG. **10** shows a close-up view of a vent attached to the tarp body of a storage cover.

FIG. **11**A shows a vent with a flap in the rolled-up position.

FIG. **11**B shows a vent with a flap in the rolled-down positions.

FIG. **12** shows a vent with a flap held in place by a frame and further comprising a flap front cover.

FIG. **13** shows a vent with a flap held in place by a frame and further comprising a flap fastener.

FIG. **14** shows a vent with a flap held in place by a frame with triangular frame legs.

FIG. **15** shows a vent with a flap in the closed position covering the vent opening.

FIG. **16** shows a plan view of a vent comprising a solid vent body and a removably attached mesh layer wherein the flap is lifted to expose the mesh layer.

FIG. **17** shows a plan view of a vent comprising a solid vent body and a removably attached mesh layer wherein the mesh layer is lifted to expose the solid vent body.

FIG. **18** shows a plan view of a vent prior to installation.

FIG. **19** shows the placement of a vent onto a tarp body.

FIG. **20** shows the attachment of the vent to the tarp body using tape.

FIG. **21** shows the vent taped to the tarp body.

FIG. **22** shows the lifting of the flap to expose the mesh layer.

FIG. **23** shows the flap in a fully rolled-up position and exposing the mesh layer.

FIG. **24** shows the lifting of the mesh layer to expose the vent body.

FIG. **25** shows the mesh layer fully lifted and exposing the vent body.

FIG. **26** shows the cutting away of the vent body to expose the tarp body.

FIG. **27** shows the installed vent after the both the vent body and tarp body have been cut away.

DETAILED DESCRIPTION

The Ventilation System

Storage covers **10** for covering particulate piles can come in a variety of sizes and shapes, are made from a variety of materials, and often are designed to specific customer specifications. FIG. **1** shows a side view of a particulate pile surrounded by a retaining wall **12**, secured by angle iron braces **14**, and covered by a circular-shaped storage cover **10**. FIG. **4** shows a side view of an alternative configuration wherein a particulate pile is surrounded by a retaining wall **12** and covered by an oval-shaped storage cover **10**. FIG. **5** shows yet another alternative configuration wherein the storage cover **10** is secured to the ground rather than a retaining wall **12**.

The retaining wall **12** can be solid or perforated (as shown in FIGS. **1** and **4**). When the retaining wall **12** comprises perforations **16**, this allows for air to flow through the retaining wall **12**. The tarp body **18** may be made from a variety of materials. However, usually the tarp body **18** is made from a water-proof, non-permeable fabric, such as polyvinylchloride or polyethylene, that protects the particulate material from rain, moisture and weather, but does not allow air to flow through the tarp body **18**.

It is advantageous to aerate a covered particulate pile to prevent molding, moisture migration, and insect or rodent infestation. To aerate a particulate pile, aeration fans **15** may be installed along the perimeter of the storage cover **10** (as can be seen in FIGS. **1-7**) to draw air out of the particulate pile. The aeration fans **15** can be of any of the types and sizes known in the art, and are generally selected based on customer specifications. For example, a Grain Guard™ galvanized vane axial or centrifugal aeration fan (sold by Ag Growth International) may be used. Generally, aeration fans **15** are installed every 20-30 feet, but may be installed closer together or farther apart.

In an attempt to draw air from the interior of the particulate pile, rather than from just the perimeter of the pile (where the fans are located), aeration pipes **30** are attached to the aeration fans **15** and positioned on the ground prior to depositing the particulate material. Aeration pipes **30** are generally made from perforated corrugated polyethylene pipe, but pipes made of metal and other types of plastics and materials known in the art may also be utilized. Aeration pipes **30** of various diameters may also be used with aeration pipes **30** generally being 12-24 inches in inner diameter.

The aeration pipes **30** can be configured in various arrangements. For example, FIG. **7** depicts aeration pipes **30** in a T-shaped arrangement with an aeration pipe stem **32** attached to an aeration fan **15** and two aeration pipe arms **34** attached to, and extending away from, the distal end of the aeration pipe stem **32**. The length of the aeration pipe stem **32** and each of the two aeration pipe arms **34** depend on the size of the particulate pile and customer specifications. In one example, the aeration pipe stem **32** is 60 feet in length and the pipe arms are each 40 feet in length. In this configuration, air is drawn through the distal ends of the aeration pipe arms **34** and through the perforations in the lengths of the aeration pipes **30** in an attempt to more uniformly pull air from the bottom of the particulate pile.

An alternate configuration of aeration pipes **30** is shown in FIG. **3**. In this configuration, single aeration pipe **30** is attached to an aeration fan **15** and extends towards the center of the particulate pile. In this configuration, air is drawn through the distal end of the aeration pipe **30** and through the perforations in the lengths of the aeration pipes **30** in an attempt to more uniformly pull air from the bottom of the particulate pile. Again, the length of the aeration pipes **30** will depend on the size of the particulate pile and customer specifications, but, in one example, the aeration pipes are each 100 feet in length. However, even with the use of theses aeration pipes **30**, air flow is still concentrated at the bottom of the pile rather than throughout the height of the pile.

The present invention incorporates a vent **17**, or multiple vents **17**, within the tarp body **18** of the storage cover **10**. We speculate that this increases the effectiveness and efficiency of the aeration of the particulate pile by creating air flow pathways that extend from the vents **17** (located at or near the top of the pile) to the fans (located at or near the bottom of the pile). Thus, we speculate that the present invention will advantageously provide aeration through the height of the particulate pile and not at just the base of the particulate pile.

As can be seen in FIG. **8**A, when a solid tarp body **18**, without vents **17**, is used while aerating a particulate pile, air enters through the perforations **16** of the retaining wall **12**, and then during aeration, the aeration fans **15** pull the air through the aeration pipes **30** and out of the pile. However, in this arrangement, air only flows through the base of the particulate pile (as depicted by the arrows in FIG. **8**A). However, when the vents **17** of the present invention are incorporated into the storage cover **10**, we speculate that the vents **17** will provide an additional source of aeration air. As shown in FIG. **8**B, in this embodiment during aeration, we speculate that the aeration fans **15** pull air from the top of the pile to the base of the pile and through the aeration pipes **30** and out of the pile. Thus, by utilizing the vents **17** of the present invention, we speculate that a more even distribution of aeration air is created that will flow through a greater area of the particulate material.

The number of and location of the vents **17** incorporated into the tarp body **18** may vary based on customer preferences. As one example, FIG. **3** shows eight vents **17** placed so that they are located between the aeration pipes **30** when viewed in the plan view. While FIG. **3** shows one vent **17** between each aeration pipe **30**, more or less vents **17** could be utilized and the vents **17** could alternatively be located above the aeration pipes **30**. Additionally, the vents **17** can be placed at various distances from the center of the tarp body **18**. In one example, the vents **17** are between 5 and 30 feet from the center of the tarp body **18**. As another example, FIG. **7** shows four vents **17** placed so that they are located between the aeration stems **34** when viewed in the plan view. Again, greater or fewer vents **17** could be utilized, and may be placed in various locations, depending on the customer's specifications. In one example, the vents **17** are between 5 and 15 feet from the longitudinal center line of the oval-shaped tarp body **18**. We speculate that there will be a better distribution of aeration air through the particulate pile if the vents **17** are not directly above the aeration pipes **30** (or, in other words, if the vents **17** are offset from the vertical plane created by the length of the aeration pipes **30**).

The vents **17** themselves may also exist in various configurations. As shown in FIG. **9**A, the vent **17** may comprise a single vent opening **92**. In one example, the vent opening **92** is rectangular in shape and is approximately 7 feet by 6 feet. In another example, the vent opening **92** is between 25 and 100 square feet in area. However, the vent openings may be larger or smaller depending on the size of the particulate pile and customer specifications. Alternatively, as shown in FIG. **9**B, the vent **17** may comprise multiple vent openings **92**. These vent openings **92** may be square, rectangular, circular or another shape. In one example, the vent openings **92** are each square in shape and are 1 to 2 feet by 1 to 2 feet in size with approximately 6 inches between each vent opening **92**. Additionally, the vent openings **92** (whether single or multiple) may be covered by a mesh layer **94**. Various types of meshes known in the art can be used for the mesh layer **94**. In one example, the mesh layer **94** is made of TenCate Nicolon® 47719 fabric. We speculate that this mesh layer **94** will serve to keep the particulate material from escaping out of the vents **17** of the storage cover **10**.

Because the vents **17** may provide a pathway for rain, moisture and other weather to enter the particulate pile (which is undesirable), it is advantageous to also incorporate a method of covering the vents **17** when inclimate weather is expected. One embodiment for covering the vents **17** is using flaps **1101**, as shown in FIGS. **11**A and **11**B. The flaps **1101** can be made of the same or a different material than the tarp body **18**. As an example, the flaps **1101** may be made from polyvinylchloride or polyethylene. FIG. **11**A shows a flap **1101** for covering the vent opening **92** wherein the flap **1101** is shown in the rolled-up position.

The top of the flap **1101** is connected at the flap seam **1102** to the area surrounding the vent (also referred to as the vent body **90**). The flap **1101** can be connected to the vent body **90** by sewing, gluing, heat sealing or using other attachment methods known in the art. The flap **1101** can be rolled-up to allow air to enter the particulate pile, and, alternatively, when inclimate weather is expected, the flap **1101** can be un-rolled to cover the vent opening **92**, as shown in FIG. **11**B, thus preventing rain, moisture or other weather from entering the particulate pile. Additionally a method of securing the flap **1101** in the rolled-up position (e.g., hook and loop fasteners, zippers, grommets and zip-ties, etc.) may also be utilized.

The vent opening **92** may also be completely or partially surrounded by a flap fastener **1108** to secure the flap **1101** to the vent body **90** when in the rolled-down position, and to keep out rain, moisture and other weather. The flap fastener **1108** may comprise hook and loop fasteners, zippers, grommets and zip-ties, or other fastening methods known in the art. The vent **17** may also utilize ropes **1104** to divert rain, moisture and other weather away from the vent opening **92**. As shown in FIG. **11**A, a length of rope **1104** can be placed (by either attaching to the vent body **90** or embedding it within or under the vent body **90**) alongside the vent opening **92** to divert rain away from the vent opening **92** and keep moisture out of the particulate pile. Also, the flap **1101** may comprise a flap pocket **1106** at the edge of the flap **1101** opposite the flap seam **1102**. A weighted object such as a dowel or pipe may be placed in this flap pocket **1106**. The dowel or pipe in the flap pocket **1106** will provide weight to aid in keeping the flap closed against the vent body **90** when the flap **1101** is in the closed or rolled-down position, and can also aid in easily rolling up the flap **1101** when the flap **1101** is in the rolled-up position.

Another embodiment for covering the vents **17** is shown in FIG. **12**. In this embodiment a triangular prism shaped frame **1204** is placed around the vent opening **92** and the flap **1101** is attached to the frame **1204** so that the flap **1101** extends over at least a portion of the vent opening **92**. The frame **1204** may alternatively be in the shape of a cube, cuboid or another shape. Specifically the flap **1101** shown in FIG. **12** is comprised of a first side flap piece **1205**, a second side flap piece **1206**, a top flap piece **1207** and a front flap cover **1202**. The first side flap piece **1205** and the second side flap piece **1206** are attached to the parallel sides of the triangular prism shaped frame **1204** and the top flap piece **1207** is attached to the top face of the triangular prism shaped frame **1204**. The front flap cover **1202** is attached along one edge to the triangular prism shaped frame **1204**. This allows the front flap cover **1202** to be placed in the open position (thereby allowing air to enter the pile through the vent **17**) or the closed position (thereby blocking rain, moisture and weather from entering the pile through the vent **17**). FIG. **12** shows the front flap cover **1202** in between the

opened and closed position. Further, the front flap cover **1202** can be secured in the open position by attaching the front flap cover **1202** to the top flap piece **1207** using hook and loop fasteners or any fastening methods known in the art.

FIG. **13** shows an alternate frame **1204** and flap **1101** design. In this embodiment, the frame **1204** is U-shaped and comprised of a first frame leg **1208**, a second frame leg **1209** and a frame center **1210**. The frame **1204** is placed adjacent to the vent body **90** so that it extends outward from the vent body **90**. In one example, the frame **1204** is placed so that it is perpendicular to the vent body **90**. The first side flap piece **1205** and the second side flap piece **1206** are attached to the first frame leg **1208** and the second frame leg **1209** respectively, and the top flap piece **1207** is connected to the frame center **1210**. Thus, the U-shaped frame **1204**, adjacent to the vent body **90** and extending outward from the vent body **90**, holds the flap **1101** away from the vent opening **92** and allows air to enter the particulate pile. In one example, the first and second frame legs **1208**, **1209** are each 12 inches in height and the frame center **1210** is 8 feet in length. However, the frame **1204** may be larger or smaller size.

Alternatively, the first frame leg **1208** and the second frame leg **1209** may be triangular in shape or may take another alternative shape. An exemplary frame **1204** with triangular-shaped first and second frame legs **1208**, **1209** is shown in FIG. **14**.

Due to the shape of the frame **1204** (and the flap **1101** covering the frame **1204**) we speculate that the flaps **1101** shown in FIGS. **12** and **13** will prevent most rain, moisture and other weather from entering the vent opening **92**. However, to further prevent rain, moisture and other weather from entering the vent opening **92** in severe weather, the flap **1101** can be secured in the closed position. For example, in the configuration of FIG. **12**, the front flap cover **1202** can be placed in the closed position and fastened to the frame **1204** and/or vent body **90** using hook and loop fasteners or any other fastening method known in the art.

The embodiment of FIG. **13** can be constructed so that the first frame leg **1208** and the second frame leg **1209** are removably connected to the first side flap piece **1205** and the second side flap piece **1206**, thus allowing the first and second frame legs **1208**, **1209** to be disconnected from the first and second flap pieces **1205**, **1206** and placed parallel to the vent body **90**. By disconnecting and laying the first and second frame legs **1208**, **1209** parallel to the vent body **90**, it allows the top flap piece **1207** to collapse and cover the vent opening **92**, further preventing rain, moisture and other weather from entering the vent opening **92** in severe weather. The frame **1204** with the first and second legs **1208**, **1209** disconnected from the first and second flap pieces **1205**, **1206** is shown in FIG. **15**. Alternatively, the vent **17** can be constructed so that the frame **1204** is completely removable from the first side flap piece **1205**, the second side flap piece **1206** and the top flap piece **1207**. Optionally, after collapsing the top flap piece **1207**, the top flap piece **1207** can further be secured to the vent body **90** using hook and loop fasteners or any fastening methods known in the art.

In an alternate embodiment, the vent **17** is a separate and distinct piece from the tarp body **18** to allow for the vent **17** to be installed after a storage cover **10** is deployed. In this embodiment, as shown in FIGS. **16** and **17**, the vent **17** is comprised of a solid vent body **90** wherein a flap **1101** is attached to the top of the vent body **90** at the flap seam **1102**. The flap **1101** can be connected to the vent body **90** at the flap seam **1102** by sewing, gluing, heat sealing or using other attachment methods known in the art. As with the previously described embodiments, the flap **1101** can be in the rolled-up position or the rolled-down position. FIG. **16** shows the flap **1101** partially rolled-up. Additionally a method of securing the flap **1101** in the rolled-up position (e.g., hook and loop fasteners, zippers, grommets and zip-ties, etc.) may also be utilized.

The vent **17** may further comprise a flap fastener **1108** along the perimeter of the vent body **90** and along the perimeter of the underside of the flap **1101** so that the flap **1101** may be removably attached to the vent body **90** if desired. The flap fastener **1108** may comprise hook and loop fasteners, zippers, grommets and zip-ties, or other fastening methods known in the art. The vent **17** may also utilize ropes **1104** to divert rain, moisture and other weather away from the vent opening **92**. As shown in FIG. **16**, a length of rope **1104** can be placed (by either attaching to the vent body **90** or embedding it within or under the vent body **90**) substantially parallel to the side edges of the vent body **90** to divert rain away from the center of the vent **17** and keep moisture out of the particulate pile.

This embodiment of the vent **17** may further comprise a mesh layer **94**. In this particular embodiment the mesh layer **94** is removably attached over the solid vent body **90** (in contrast to a previously described embodiment, the vent **17** of this embodiment does not comprise a vent opening **92** until after it is attached to the storage cover **10**, as is described in detail below). The configuration of this embodiment allows the vent **17** to be more easily installed on an already deployed storage cover **10**, as is described in detail below.

FIG. **17** shows the mesh layer **94** partially detached to expose the vent body **90** underneath. The vent **17** may further comprise mesh fasteners **1701** secured to the perimeter of the underside of the mesh layer **94** and to the vent body **90** so that the mesh layer **94** may be attached to or detached from the vent body **90**. The mesh fasteners **1701** may comprise hook and loop fasteners, zippers, grommets and zip-ties, or other fastening methods known in the art.

Method of Installing the Ventilation System

In one method of installing a vent **17** of the present invention (wherein the vent **17** is comprised of the vent body **90** enclosing the vent opening **92** and any vent flaps **1101** or frame **1204**), the vent **17** is taken to the approximate location on the storage cover **10** where the vent **17** is to be installed. An opening of approximately the same shape, but a smaller area, as the vent body **90**, is then cut out of the tarp body **18**. The vent **17** is then placed either on top of or underneath the newly created opening so that perimeter of the vent body **90** can be attached to the inner edge of the newly created opening, and thereby creating a vent seam **1002** around the perimeter of the vent body **90** that connects the vent body **90** to the tarp body **18**. This attachment can be performed by sewing, gluing, heat sealing or any other attachment method known in the art. The attachment of a vent **17** to the tarp body **18** is shown in FIG. **10**.

In another method of installing a vent **17** of the present invention, the vent opening **92** is created by cutting an opening out of the tarp body **18** using scissors, a knife or any other cutting device. In this situation, the tarp body **18** and the vent body **90** are one in the same. The flap **1101** (and to the extent desired, ropes **1104** and flap fatteners **1108**) is then attached to the area of the tarp body **18** surrounding the newly created vent opening **92** by sewing, gluing, heat sealing or using any other attachment method known in the art. If a mesh layer **94** is desired, the mesh layer **94** is attached to the newly created vent opening **92**.

FIGS. **18-27** depict yet another method of installing a vent **17**. This method may utilize the vent **17** embodiment shown in FIGS. **16** and **17**. We speculate that the vent **17** embodiment shown in FIGS. **16** and **17** will allow for easier installation of a vent **17** on an already deployed storage cover **10**. However, the embodiment of FIGS. **16** and **17** may be used in connection with a storage cover **10** that has not already been deployed.

As shown in FIG. **18**, a vent **17** having the embodiment depicted in FIGS. **16** and **17** is utilized. Then, as shown in FIG. **19**, the vent **17** is placed on top of the tarp body **18** at the location where ventilation is desired. As shown in FIG. **20**, the edges of the vent body **90** are attached to the tarp body **18** using tape **2001** such as 4 inch wide cross linked butyl, polyethylene backed tape (alternatively, the edges of the vent body **90** can be attached to the tarp body **18** by sewing, gluing, heat sealing or using any other attachment method known in the art). FIG. **21** depicts the vent **17** attached using tape **2001** to the tarp body **18**. Optionally, it may be desirable to also utilize double sided tape along the perimeter of the underside of the vent body **90** to further secure the vent body **90** to the tarp body **90**.

Then, as shown in FIG. **22**, the flap **1101** is lifted to expose the mesh layer **94** underneath. FIG. **23** shows the flap **1101** in the fully rolled-up position to fully expose the mesh layer **94**. The mesh layer **94** is then detached to expose the vent body **90** underneath.

Next, as shown in FIG. **26**, a portion of the vent body **90** is cut away, using scissors, a knife or any other cutting device known in the art, to create a vent opening **92**. The vent body **90** may be cut to create a vent opening **92** in various shapes or sizes. However, we speculate that it will be advantageous to remove as much of the vent body **90** located inside the mesh fasteners **1701** as possible, as this will allow the maximum amount of ventilation through the vent opening **92**. Then, the portion of tarp body **18** that is exposed through the vent opening **92** is also cut out to expose the particulate to the atmosphere and allow ventilation. The portions of the vent body **90** and tarp body **18** that have been cut out may then be discarded.

After the vent opening **92** is created and the desired portion of the tarp body **18** removed, the mesh layer **94** may be reattached to the vent **17** via the mesh fasteners **1701** so that the mesh layer **94** fully covers the vent opening **92**, thus keeping the particulate material from escaping out of the vent opening **92** of the storage cover **10**. The flap **1101** may then be reattached to the vent **17** via the flap fasteners **1108** to prevent rain, moisture and other weather from entering the vent opening **92**. Alternatively, if rain, moisture or other weather is not a concern, the user may decide not to reattached the flap **1101**.

We speculate that the embodiment shown in FIGS. **16-17** and installed using the method shown in FIGS. **18-27**, will be particularly useful when installing a vent **17** within a storage cover **10** that is already deployed. As previously discussed, it is advantageous to install vents **17** near the top of the storage cover **10** to increase the air flow through the height of the particulate pile. However, installing these vents **17** at the top of the deployed storage cover often results in the installation persons be exposed to high winds and inclimate weather during installation. Because the vent **17** is attached first, before removing a portion of the tarp body **10**, it will prevent the user from having to carefully line up the vent **17** so that it correctly aligns with an opening previously made in the tarp body **10**, a task that we speculate would be very difficult in windy conditions or inclimate weather.

Additionally, we speculate that the vent **17** embodiment of FIGS. **16** and **17** wherein the mesh layer **94** and flap **1101** are located above the solid vent body **90** (and thereby the vent body **90** creates a flat, smooth bottom surface) will allow for easier to transportion and placement of the vent **17** at the top of the storage cover **10**. However, in an alternate installation method, the vent opening **92** may be created prior to attaching the vent **17** to the storage cover **10**.

The invention claimed is:

1. A vent comprising:

a. a vent body;

b. a mesh layer removably attached to said vent body wherein said mesh layer is movable from an attached to a detached position and wherein when said mesh layer is in said attached position, said mesh layer at least partially covers said vent body; and

c. a flap attached to said vent body wherein said flap is movable from an opened position to a closed position and wherein when said flap is in said closed position, said flap covers said mesh layer.

2. The vent of claim **1** wherein said vent body is between 25 and 100 square feet in area.

3. The vent of claim **1** wherein said mesh layer comprises a perimeter and a mesh fastener wherein said mesh fastener is located at least partially along said perimeter of said mesh layer.

4. The vent of claim **3** wherein said flap comprises a perimeter and a flap fastener wherein said flap fastener is located at least partially along said perimeter of said flap.

5. The vent of claim **4** further comprising a rope attached to said vent body wherein said rope is located outside said perimeter of said mesh layer.

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